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Organizational Communication in a Team-based Product Design Process. Case Study: Aalto ME310 Global Innovation Program.

MSc program in Corporate Communication

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The Objective of the study

This study seeks to improve the organizational communication in a team-based product design process. The goal of this thesis is to combine the theories of organizational communication and the recent studies in product design teams and its process to identify how the product design team communicate in each different product design process, what are the pitfalls, and how to solve them. The academic intent is to conceptualize the practices of teamwork in the product design process. The outcome is intended to help the product design teams, the company, the school teaching group, and the users to better understand the organizational communications in a product design team as well as how to improve the organizational communications in the team.

Methodology and analytical framework

The research problem was how to improve interpersonal communication in the team-based product design processes. To study the research problem, three research methods have been used: case studies, in-depth interviews, and content analysis. There are 10 semi-structured interviews of participants, teaching assistants, and company representatives in a one-year long product development project. After that, by analyzing the transcript of the interpreted interview tapes, many common pitfalls and helpful communication tips have been discussed and found out with the theoretical framework teamwork in a product design process.

Findings and conclusions

The findings of this study show that team dynamic problem is inevitable in the product design process due to the different backgrounds and expertise in the product design team. Moreover, the team dynamic problem seems to be aggregated from small disagreements to team conflicts or personal conflicts inside the team. Thus, it is essentially important to notice those potential team dynamic problems and to solve those before they exacerbate. Five kinds of practical advices are given: to use drawing and writing instead of speaking to convey the messages, to use decision metrics to make decisions, to use "I wish, I like" section, to have some team building activity, and to use online communication tools. In the "I like, I wish" section, the key message is to create a sympathetic and trustworthy communication climate. Therefore, this study not only reveals the pitfalls in teamwork of a product design team, but also gives the suggestions to the team dynamic problems in the product design team with the organizational communication conceptual framework analysis.

Keywords: Organizational Communication, Product Design Process, Team Dynamic Problem

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1. INTRODUCTION

This thesis addresses the study on the Organizational Communication (OC) in a team-based product design process. Although OC in teams and team-based product design process has been analyzed solely from different perspectives, there are less studies on the OC in team-based product design process. Furthermore, due to the great changes in the product design nowadays, the product design teams are facing new challenges now in order to have the user-centered design (Abras, Maloney-Krichmar & Preece, 2004). Therefore, it is significant to conduct this OC studies in a team-based product design process. And it is suggested to use OC in teams as an overarching framework to study team-based product design process. Meanwhile, a case study has been conducted to supplement the OC studies.

1.1 **Background**

This thesis examines the existing theories and practices of organizational communication in team-based product design and development process. As a communication professional, how can he/she facilitate the product design and development in a product design team, and how can he/she use the communication knowledge to better contribute to a product development project, are the two major research questions in this thesis. Nowadays, many scholars and practitioners in product design and development have realized that product development is a multidisciplinary activity requiring contributions from nearly all the functions of a firm according to a large amount of product development practices (Ulrich, 2003, p3; Roozenburg & Eekels, 1995; Akao, King & Mazur, 1990…). However, the reality is that people in the newly created team with expertise from different departments of the firm are not communicating well in their work, especially when short money and time resources are provided for the project, as well as when the team members are from different cultures under the trend of globalization, etc. (Davila, 2000; Brown & Eisenhardt, 1995…). Therefore, increasing the efficiency and effectiveness of the organizational communication in a team-based product design process is the core research topic of this thesis.

To start with, the product design process has been explicitly explored in alignment with the case study. Product design is different from the product development process, and product design is part of the product development process, which consists of planning, concept development, a little bit of system-level design (Tschimmel, 2012). However, concept development has also been developed further by introducing the design thinking theories into the product design process in order to have a user-centered design (Ulrich, 2003, p79). After many practices in the product design project by many

scholars (Wiesche, Leifer, Uebernickel, Lang, Byler, Feldmann, ... & Suzuki, 2018), a design thinking course phase, applied also in the Aalto ME310 Global Innovation, has been formed: Formation, Design Space Exploration (critical Function, dark horse, funky, functional, X is defined), Final Prototype. Also, it involves an occurring design thinking process: define the problem, need-finding + benchmarking, ideation, prototyping, testing with users (Wiesche et al, 2018). Furthermore, it introduced the product design teams and summarizes the teamwork in the product design process. Surprisingly, there are more team dynamic problems in the teamwork, and avoiding or knowing how to deal with those team dynamic problems will greatly improve the efficiency of the product design project (Maznevski & Chudoba, 2000).

In the product design and development, that "people are not speaking the same language", is defined as miscommunication or non-effective communication in the human communication study by Heath and Bryant (2013, p91). A very widely used definition of human communication is that communication is the process of **"sending"** and **"receiving"** messages between two or more people through verbal or nonverbal means (Kreps, 1986, p10). Moreover, Eisenberg, Goodall & Tretheway (2006, p29-40) has introduced the four conceptions of organizational communication: (1) communication as information transfer, (2) communication as transactional process, (3) communication as strategical control, (4) communication as a balance of creativity and constraint. Miscommunication occurs only when no message is received or when the message that is received is not what the sender intended, and typical pitfalls in organizational communication include information overload, distortion, and ambiguity.

Because the product design project is based on the team, communication theories in teams has been addressed. The product design team is a mixture of the project teams, work teams, and quality-improvement teams in terms of its multidisciplinary team members to develop a proofed of concept during the product design process (Eisenberg, Goodall & Trethewey, 2007, p243-240). In a team, making room for the others and balancing the leadership are the most crucial things to make relatively successful teamwork in the end (Perkins, 2008, p98-100). However, it has also been mentioned by Begley (2009) that team conflicts are inevitable in any teamwork. Therefore, facilitating the team with conflict resolutions skills is getting more and more important (Friend, & Cook, 1992, p100).

In addition, organizational communication in the age of globalization leads us to global and multicultural perspectives in organizational communication (Cheney, Christensen, Zorn & Ganesh, 2010, p17). Intercultural communication has been defined by Perkins (2008, p163) that as

“communication between individuals or groups from different cultural backgrounds whose diversity of symbol systems and cultural perspectives influences that communication exchange”. In order to deepen the understanding of the cultural influence on organizational communication, Hofstede’s cultural dimensions theory has been introduced (Ferraro, 2006, p10) to analyze the cross-cultural communication at teamwork.

The last but not the least, there are so many communication tools involving in the group work such as google doc, “what’s up” group, doodle, web call, etc (Morelli, 2006). It examines the advantages and disadvantages of different communication tools, and how those communication tools assist in the teamwork (Eyrich, Padman & Sweetser, 2008).

1.2 **Research Objectives and Questions**

Nowadays organizational communication is becoming more and more important for any organizations including the companies, non-profit organizations (NGOs), associations, governments, workshop, teamwork, and so on. However, according to research from the Society for Human Resource Management, many companies are losing money due to poor communication (Shrm, 2013). It has been reported on their research that 400 companies with 100,000 employees cited an average loss per company of 62.4 million dollars per year from inadequate communication to and between employees (Shrm, 2013). A separate article said that miscommunication cost smaller companies of 100 employees an average of 420,000 per year (Kehoe & Wright, 2013).

Also, in the product design studies, User-Centered Design is becoming more and more important, which emphasizes the importance of the users in the product design process (Abras & Preece, 2004). Furthermore, there are people from different expertise involving in the product design project more and more often such as the expertise in marketing, engineering, product designer, etc. To reduce the misunderstandings, disagreements, and even team conflicts in the team, there is a great need in how to collaborate with each other.

In considering those two trends in the previous studies, the point is how we can solve the poor organizational communication problems and keep effective communication in a team-based product design team at the same time. Mou, Z. (2011) has described that communication is the more and more true representation of the management itself, poor organizational communication problems can be managed and improved. Also, it has been mentioned by Folds, L. (2003) that, for successful meetings

in the organizational communication, positioning beforehand is everything to avoid the poor communication problems. Moreover, Breen, V. (2005) has done some real experiment to prove that consensus problem-solving increases perceived communication openness in organizations. The experiment was conducted with members of three established teams in different organizations, and participants perceived a significant increase in communication openness during these sessions as compared to their previous problem-solving sessions. The increase in communication openness suggests an improved openness to the flow of information among team members. The results of this study provide early indicators of successful applications for this consensus model, including improving the participation of team members during strategic planning and enhancing the upward flow of information to senior decision-makers for purposes of organizational change and development (Breen, V. 2005).

In addition, in the user-centered product design process, the different concept generation and concept selection methods have often been used to help the product developers to generate innovative ideas and concepts and to make group decisions for the developer team. Therefore, the concept selection methods can also be treated as a solution to avoid the organizational communication problems within a team-based product team. To be specific, the goal of concept generation is to explore the space of product concepts which may be applied to meeting the customer needs, and the concept selection is the activity in which various product concepts are analyzed and sequentially eliminated to identify one preferred concept (Ulrich. K. T & Eppinger. S. D., 1995; Griffin, A., 1995). It has been mentioned by Sosa, Eppinger, & Rowles (2004) that dealing with interdependences across organizational and functional boundaries moderates the impact of design interface strength, and indirect team interactions are contingent on system modularity in the complex product design process involving different expertise. Therefore, it is significant for the product design team to understand the organizational communication in order to develop a successful product, to avoid the team dynamic problems, and to solve unnecessary cost, etc.

To achieve those research objectives mentioned above, the whole research starts from the research question: **how to improve the organizational communication in the team-based product design process**? To answer the research question, four sub-questions are introduced as below:

1) How do people communicate with each other inside a product design team?
2) What are the different roles or objectives that each teammate is playing in the team via different product design process?

3) What are the pitfalls of teamwork in the product design process?
4) What are the key skills needed in team conflicts in the product design team?

In the four sub-questions, the first two questions focus on the general understandings of the organizational communications in the product design process. The last two questions focus on the pitfalls of teamwork and needed skills in the product design teams in terms of better organizational communication, which applies the previous theoretical studies into practices.

In conclusion, the whole research is around the core research question on how to improve the efficiency and effectiveness of organizational communication in team-based product design process. Around this research problem, we have one main research questions, which is how to improve the efficiency and effectiveness of organizational communication in a team-based product design process. Together, this one research question has been divided into four small research questions to focus on the different aspects of organizational communication, product design process, and the team studies.

1.3 Structure of the Thesis

The thesis consists of six chapters to report both the theoretical studies and empirical case studies.

Chapter one introduces the research background, research objectives, and research problems together with research questions. It keeps the research clearer and goal-orientated when conducting both theoretical studies and empirical studies. However, those research objectives and research problem are not coming spontaneously. The background in this chapter provides sufficient reasoning for the structured research objectives and research problem to improve the OC in team-based product design process.

Chapter two is the empirical research part, it examines different theories related to organizational communication, product design process, and team studies of the previous scholars. To be more precise, it starts with the product design process and an overview of the product design team and teamwork in product design. Then it reviews the different concepts in organizational communication, as well as the pitfalls in organizational communication. After that, it introduces the overall communications in teams such as the different types of teams, making room for the others, leadership and communication climate, team conflict and group membership, and conflict resolution. In the

next, it describes the intercultural communication and Hofstede's cultural dimension theories. In the last but not the lease, it briefly introduced the communication tools used recently due to the development of the information technologies. In the last, it structures a framework to integrate the literature review part together according to research objective.

Chapter three specifies the research methods used in this thesis, the case introduction, the collected data. In the research methods, it discusses the case studies as one of the most used qualitative research methods. After that, it introduces the case itself. In the collected data, it presents the interviews design and the result.

Chapter four focuses on the findings of the empirical research part, which also outline the results of the collected data in terms of the research questions.

Chapter five presents the 'Discussion', which utilizes the content of the previous chapter and analyzes them in order to prove whether the four research questions are answered. At the same time, the Findings are compared to the literature of Chapter two so as to determine any novelties within the field of research.

Chapter six explains the conclusion of the whole research of this thesis from the research summary and research result. Also, it has talked about the practical implications, limitations of the study, and the suggestions for future researches in OC.

2. LITERATURE REVIEW

This chapter will review the literatures relevant to this master's thesis. All of the sections in this chapter review the general literatures on the topic in the beginning, and then dive into the more specific theory or model that is of relevance to this study. The first section presents research on the general definition of organizational communication (OC), more specifically, it illustrates the different approaches to the OC. The second section addresses the communication in teams, and it involves the leadership and ownership studies. The third section highlights interpersonal communication, in general, it focuses on the relation communications. The fourth section elaborates on cross-culture communication. The last section gives a brief description of the design thinking process.

2.1 **Product Design Process**

In order to analyze the organizational communication in product design teams, it is vital to review the product design process. However, there is a difference between the product design process and product development process. To distinguish that, the first section focuses on the definition of product design in general when the research examines the organizational communication in a product design process. In the next section, it focuses on the involved teamwork in a product design process.

2.1.1 Product Design VS Product Development

Product development has been defined by Ulrich (2003, p2) as the set of activities beginning with the perception of a market opportunity and ending up with the production, sales, and delivery of a product. To be more specific, in Figure 1, there are six generic steps of the product development process: Planning, Concept Development, System-Level Design, Detail Design, Testing and Refinement, and Production Ramp-Up (Ulrich, 2003, p10). Additionally, it has been mentioned by Ulrich (2003, p14) that a product development process is like the sequence of steps or activities that an enterprise employs to conceive, design, and commercialize a product. It means that the input to the process is a mission statement, and the output of the process is the product launch. However, it is not product design by using the design thinking process.

The term **Design Thinking** has gained attention over the past decade in a wide range of contexts beyond the traditional preoccupations of designers (Kimbell, 2011). To understand what is product design by design thinking, we have to know what design thinking is. It has been defined by IDEO as below (Brown, 2009).

"Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success." IDEO

In the context of product design, in Figure 1, it emphasizes the planning and different concept development phases of the product development process (Tschimmel, 2012).

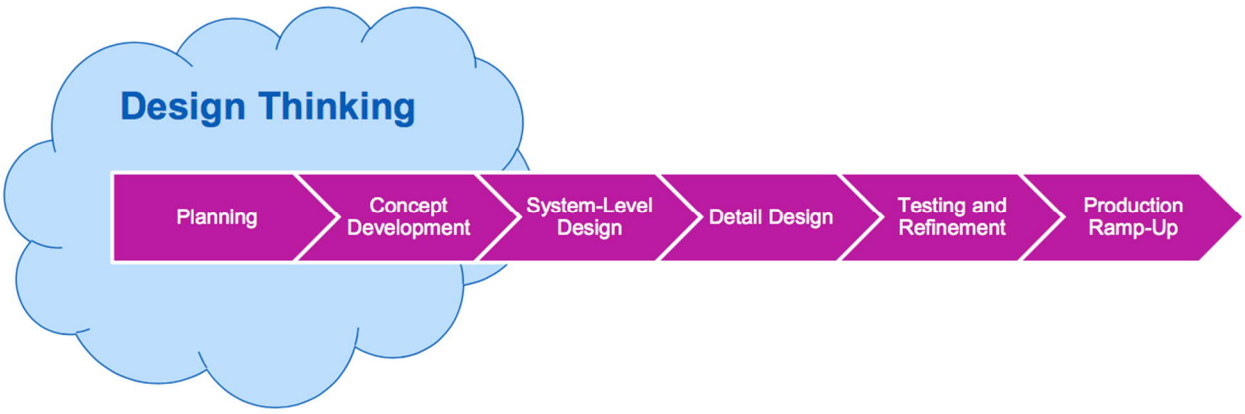


Figure 1. Product development process VS design thinking (Tschimmel, 2012).

Planning is also known as the preparation before the product design and development project due to the time, money, and human resources cost. Before moving to the next phases, those recourses should be gathered. In the next section2.5.2, it describes the complexity of human resources, as well as its management and collaboration.

In the concept development phase, the needs of the target market are identified, alternative product concepts are generated and evaluated, and a single concept is selected for further development (Ulrich, 2003, p16). To be more specific, a concept can be described as a form, function, feature of a product accomplished by a set of specifications, an analysis of competitive products, and an economic justification of the project (Ulrich, 2003, p16). Because concept development is the actual beginning of the whole product design and development process, it decides the success of the whole product design and development project. Also, it is a phase that having lots of connections with the end-users and customers. If it fails in this process, we are wasting the time to develop a user-centered design (Abras, Maloney-Krichmar & Preece, 2004). Therefore, the concept of product design can be seen as a concept development process due to the emphasis on the user-centered concept development.

2.1.2 Product Design Process

In the last section, it has been mentioned that Product design, also known as concept development, focus on the user-centered concept development. The degree to which a product satisfies customers and can be successfully commercialized depends to a large measure on the quality of the underlying concept (Ulrich, 2003, p78).). In Figure 2, it can be seen that concept development process begins with a set of customer needs and target specifications and results in a set of product concepts from which the team will make a final selection (Ulrich, 2003, p79). After that, the design team need to establish the target specification by analyzing competitive products. Then after that, it requires the design team to generate as many concepts as possible, where different ideation methods can be applied. In the next, the design team has to select a most user-centered product concept with the most potentials in the market by analyzing the economic potential, where the concept selection methods can be applied. Then, it requires to refine those specifications and plan the remaining development project, which includes mainly the engineering part.

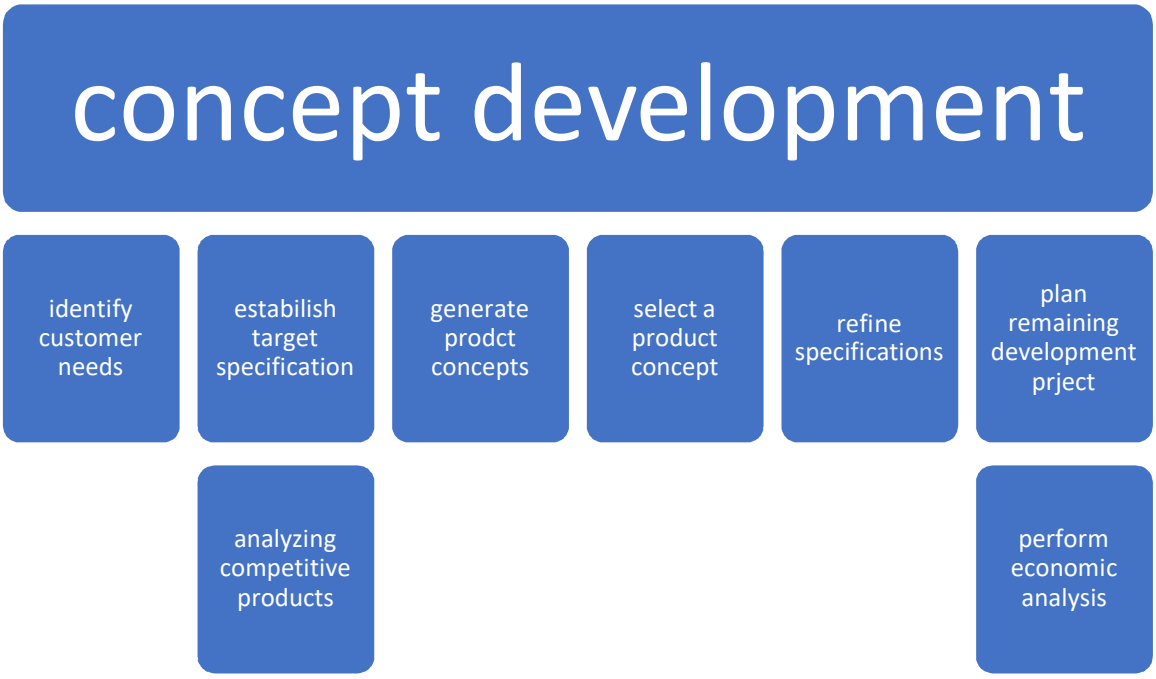


Figure 4. Concept generation in the concept development phase (Ulrich, 2003, p79).

To further develop this concept, many practices conducted by the scholars (Wiesche, Leifer, Uebernickel, Lang, Byler, Feldmann, ... & Suzuki, 2018) have developed the product design into a design thinking course phase in Figure 3, and a design thinking microcycle in Figure 4.

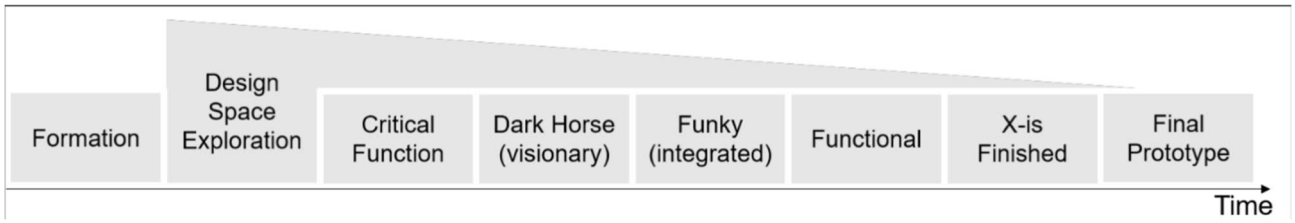


Figure 5. The product design thinking course phase (Wiesche, Leifer, et al, 2018).

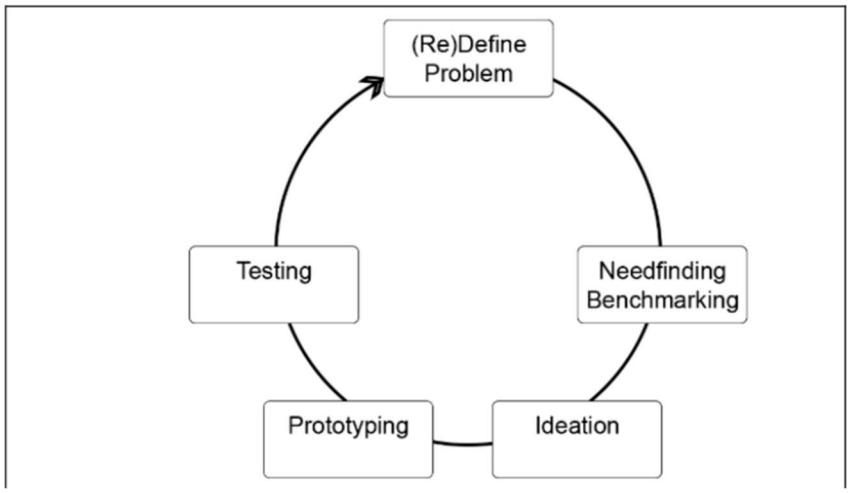


Figure 6. *A design thinking microcycle (Wiesche et al, 2018).*

To get started, the student team requires some basic instruction about the idea of the course, the design challenge, and teambuilding activities. In the next step, the student team conducts Need-finding and explores their Design Space. This phase is an ongoing phase in which the student team collects, synthesizes, and uses available information related to their design challenge. Then, Critical Functions are extracted from the problem space, which needs to be integrated into the ultimate solution. The Dark Horse phase explicitly moves the solution search outside of what might be normally considered reasonable; In the Funky phase, the most successful parts from the previous phases are connected and low-resolution prototypes are built.

The Functional phase includes the first concrete preview of the ultimate solution that integrates working functionalities. Within the X-is Finished Phase, one key functionality – the "X" – is fully implemented and tested. Such functionality should consider the core of the ultimate prototype. The Final Prototype phase includes the solution for one or several key identified needs and delivers the experience of using the real product.

Meanwhile, in figure x, within these phases, an iterative cycle of five steps is continuously iterated (Figure 3) (Vetterli et al. 2016; Hehn et al. 2018). The (current) definition of the problem is followed by the discovery of unarticulated user needs, which then inform ideation to develop new ideas. Prototyping and testing of these ideas allows for learning to what degree the targeted needs have been fulfilled, which allow for a new, more concise problem definition that restarts the cycle. Design thinking methodology provides a plethora of different elements that can be harnessed in each step of the process.

As different departments adopt design thinking in different ways and set dedicated foci on design thinking elements, Mechanical engineering departments, like the ME310 course at Stanford University, put special emphasis on physical prototype development and related activities (Wiesche, Leifer, Uebernickel, Lang, Byler, Feldmann ... & Suzuki, 2018). In conclusion, the whole product design is the beginning part of the product development, which consists the planning phase, concept development phase, and a little bit about system-level design. In practice, people have introduced the design thinking theories for the concept development phase, which extended to formation, design space exploration, critical function, Dark Horse, Funky, Functional, X is Finished, Final prototype. In addition, there is a typical iteration for each individual design thinking phases in the product design and development: define problems, need-finding + benchmarking, ideation, prototyping, testing, redefine the problem.

2.1.3 Product Design Teams

Before the product design and development project, what kind of people consist of the product design teams does have an influence on the whole product design and development project (Ulrich, 2003, p3). Product development is an interdisciplinary activity requiring contributions from nearly all the functions of a firm; however, there are three main functions: marketing, design, and manufacturing (Ulrich, 2003, p3). The marketing function enables the firm to communicate its customers in order to identify the product opportunities, to define the marketing segments, and oversee the launch and promotion of the product; the design function leads the definition of the physical form of the product to best meet customer needs including engineering design (mechanical, electrical, software, etc.) and industrial design (aesthetics, ergonomics, user interfaces); the manufacturing function is mainly responsible for designing and operating the production system in order to produce the product such as purchasing, distribution, and installation.

More importantly, these people will develop into one product development team for the project. In reality, there are some characteristics of a failure product design team such as: lacking empowerment of the team; functional allegiances transcending project goals; inadequate resources; lacking cross-functional representation on the project team, etc.

After knowing the characteristics of the product and the development teams and background, we need to understand the challenges of product development. In practices, developing a good product is difficult or there is no best product but only better ones. There are six factors which make the product development challenges:

1. Trade-offs. Sacrificing some functionalities in order to reach the other functionalities
2. Dynamics. The trend of the future design in the industrial and market.
3. Details. Mind those smaller details to save cost, etc.
4. Time pressures. Within short period, the design tasks need to be done and decisions need to be made quickly.
5. Creation. Need to be more creative and think out of the box.
6. The Satisfaction of social and individual needs. Products are invented to meet the customers' need.
7. Team diversity. It is better to have people with different skills and talents to work together for making those design decisions referring to different perspectives.
8. Team spirit. It is better to keep the product development teams highly motivated.

2.1.4 Teamwork in a Product Design Process

In the next, it illustrates the most common used design process (used also in the case) in the product design developed by Dym, Agogino, Eris, Frey, & Leifer (2005), which is a recurring process: define the design problem, need-finding + benchmarking, ideation, prototyping, test with users, and redefine the design problem, as it can be seen in Figure 4 (Wiesche et al, 2018) in the last section. Moreover, when it comes to the practices in a product design project, there is two most important teamwork, which has been implemented a lot in the actual work: concept generation method, and concept selection.

Concept Generation

Concept generation can be understood as different kinds of concept generation or ideation methodologies. The task of concept generation in product development is to find the customer needs and target the specifications and results in a set of product concepts from which the team will have a final selection (Ulrich, 1995). Good concept generation leaves the team with confidence that the full space of alternatives has been explored. There are five steps in the concept generation methodology: Clarify the problem; Search externally; Search internally; Explore systematically; Reflect on the solutions and the process. In practices, there are some good concept generation methodologies which has been widely used in the real product development practices.

Brainstorming & Mind Map

This method is the most often used in the product design and development process. There are five brainstorming procedures in order to conduct a good brainstorming section. Firstly, there should be one facilitator, who should prevent judgments and encourage participation by all the record the discussed ideas. Also, the facilitator should sometimes keep the people stay with the intended-to-solved questions instead of discussing something else. Secondly, we should form a group with 5 to 15 people with a variety of backgrounds and experiences, and it's better not to include bosses or supervisors in the group, for which it might affect the people's free participation and the generation of the creative ideas due to the consideration of the hierarchy concerns. The next, it has been suggested for all the members to review the problem for 10 minutes to understand the task clarification, customers' needs, specifications, etc. Meanwhile, it has been suggested also to write down those ideas when people are preparing for the brainstorming section. In the fourth place, it is the rapid idea generation section for 20 to 35 minutes. One thing has to be careful is that we value the quantity instead of the quality when generating those ideas. The last but not the least, when ideas start to trickle, we either stop or use other idea generators (analogies, physical principles, etc.) instead of wasting time and thinking about creative ideas for the sake of doing it.

The second important duty for the facilitator is to record the brainstorm sections and clear people's mindset, and one most used drawling is the Mind Maps. In the Figure 5, we can find the problem has been written in the center of the mind map. The second step is to add ideas and cluster them into hierarchical groups, because groups help lead to more ideas. The power of using this mind map is to link the different ideas by categorize them (Sutton & Hargadon, 1996)

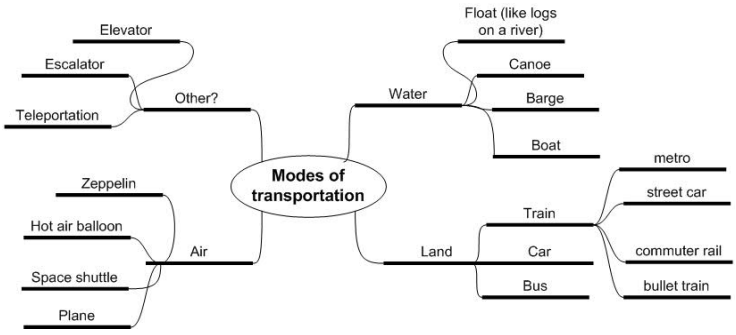


Figure 7. One example of the mind map (Sutton & Hargadon, 1996).

1. TRIZ/TIPS

TRIZ refers to problem-solving, analysis and forecasting tool, which derives from the patterns of invention studies in the global patent literature (Hua, Yang, Coulibaly & Zhang, 2006). TRIZ was developed and applied by the Soviet inventor and science-fiction author Genrich Altshuller (1926-1998) in 1946. In English the name is typically rendered as "the theory of inventive problem solving", and occasionally goes by the English acronym TIPS.

In the theories of TRIZ/TIPS, problems and solutions are repeated across industries and sciences, and patterns of technical evolution are also repeated across industries and sciences, and TRIZ identifies and codifies these principles and uses them to make the creative process more predictable (Goel & Singh, 1998).Therefore, in order to find the comparable solution, it has been advised to first identify the feature to improve such as spend and the feature to preserve such as force. Then, the website will suggest different solutions according to the categorized 40 TRIZ principles. In the cases the selected feature with spend and force, the suggested solution is number 13, 28, 15, 19, which refer to the other

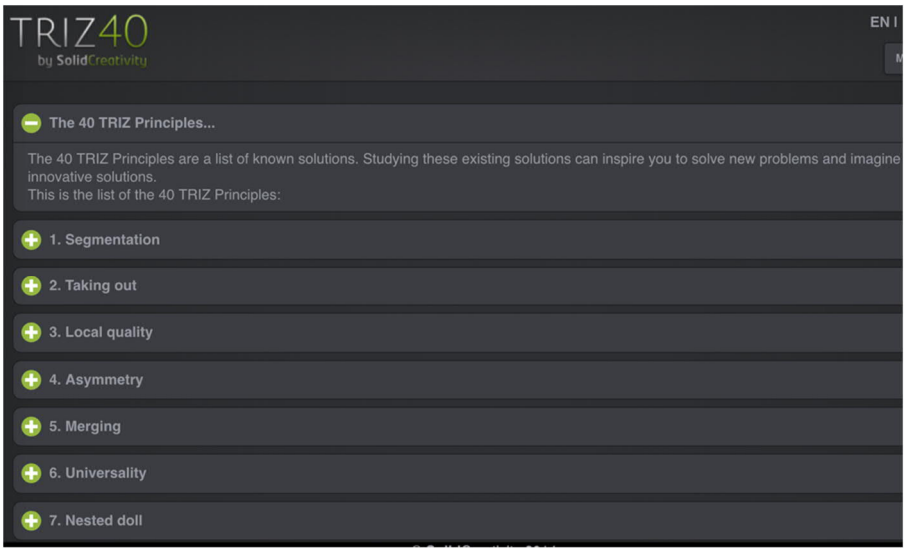


Figure 8. *The 40 concluded principles of solutions in TRIZ/TIPS (Goel & Singh, 1998).*

way around, mechanics substitute, dynamics, periodic action. In the other way around, it has given an example of bring the mountain to Mohammed instead of bringing Mohammed to the mountain and so on.

2. 6-3-5 Brainwriting

6-3-5 Brainwriting refers to a group-structured brainstorming technique, which aims to generate innovation process (Rohrbach, 1969). Briefly speaking, there are 6 participants who are required to write down or draw an idea on a specific worksheet within 5 minutes. After that, participants need to pass the working sheets to the next team member, and the next person can add or combine ideas on the previous person's worksheet. Normally it runs for 3 rounds. In total, it will collect maximum 18*3 ideas if there are no related. It requires the participants to act quickly and concentrate on thinking and writing. And it can be fewer participants.

The advantage of using 6-3-5 is to combine the individual ideation and group ideation by the rotation procedures. Secondly, it helps to reduce the peer pressure when there are some people good at talking and arguing inside the team while some don't in the regular brainstorming. The 6-3-5 can give each people equal opportunities to express themselves. Lastly, it avoids misunderstandings in the team by writing down the ideas or drawing the sketch.

3. Random word/object/picture

This method is aimed to give some intuitions to the people when people are getting stuck and couldn't think out of the box. In Figure 7, the team are required to put random objects (no sharp one) or pictures, and then the people are required to take one object from the box, which may help the people to generate some ideas by linking to the selected objects. More importantly, it helps the participants to have fun and be relaxed after a long-time brain work (Li, Wang, Li & Zhao, 2007).

Figure 9. An example of the random word/objects/pictures (Li, Wang, Li & Zhao, 2007).

4. S.C.A.M.P.E.R

The **SCAMPER** refers to a structured way of assisting students to think out of the box and enhance their knowledge, as well as an activity-based thinking process that can be performed by Cooperative learning (Michalko, 2010). Firstly, some supervisors assist the participants in selecting a particular topic, and then the supervisors instruct the participants to develop the ideas through a structured process. The detailed methodologies for the supervisors or expertise to help the participants in the project have been shown as below:

- **Substitute**
- **Combine**
- **Adjust**
- **Modify**
- **Put**
- **Eliminate**
- **Reverse**

Hence, SCAMPER has been applied to help the designers to analyze the knowledge in its creative form. See in Figure 8, there are great examples to illustrate how the SCAMPER works in product development.

Figure 10. Examples of SCAMPER ideation methods (Glenn, 1997).

5. Empathic Experience Design (EED)

Empathic Experience Design is one of the user-centered design approach, which emphasizes the user's feelings toward a product. IDEO has applied the human inspirations and human feelings into all of their designs, which turns out to meet the needs of the customers. Hence, IDEO is reported to routinely include empathic design in their projects and list the key steps to their method (Kelley & Littman, 2001). Furthermore, Leonard and Rayport have identified the five key steps in empathic design as below (Leonard & Rayport, 1997).

1. **Define the design problem** e.g Let's pick kitchen appliances
2. **Define typical and empathic users and usage environments**
    - Limited hearing (noisy)
    - Limited sight (issues with vision, dark, not looking)
    - Limited dexterity (issues with dexterity, clumsy, cloggy)
    - Limited cognitive capacity (tired, multitasking)
3. **Design empathic experiences** e.g. Limited cognitive, physical, sensory & cognitive ability
4. **Simulate empathic experiences** e.g. We have some props for you or use your own
5. **Generate concepts** e.g. Use any creativity method (e.g. 6-3-5)

Concept selection

After getting lots of ideas by the concept generation methods from unbounded creativity and divergent thinking, the question is how to select them and how to focus on some of them due to the limited resources, which is also called concept selection. In the book product design and development written by Karl (2003), concept selection has been defined as the process of evaluating whether the concepts meet the customer needs and other criteria (Karl, 2003, P107). It is known that the concept selection may not produce a dominant concept immediately. However, through several iterations, it helps to understand the design better and finally, a dominant concept will be chosen.

Under the philosophy "using a method is better than not using any" in the product design and development. It has been emphasized by Karl (2003, P107) that all teams are suggested to use some method to choose among concepts than not using any method. There are six different methods varying in their effectiveness:

- **External decision**: Concepts are decided by the customer, client, or some other external entity
- **Product champion**: An influential and experienceable member of the product development team chooses a concept based on his or her preference, usually it is the PD manager.
- **Intuition**: The concept is chosen by its "feel", the concept just "seems" better.

- **Pro and Cons**: The team lists the strengths and weakness of each concept and makes a choice based upon group opinion.
- **Prototype and test**: The organization builds and tests prototypes of each concept, making a selection based upon the test data.
- **Decision matrices**: The team rates each concept against pre-specified selection criteria, which may be weighted according to the group opinions.

Concept Screening

Concept screening is based on the method developed by Stuart Pugh in the 1980s and is often called Pugh concept selection or Pugh Chart or Pugh Matrix (Pugh, 1990). It aims to reduce the number of concepts quickly and to improve the concepts, and it is one of the decisions metrics, which has often been used in engineering for making design decisions.

Pugh Chart allows comparison of several different concepts against a base concept, creating stronger concepts and eliminating weaker ones until an optimal concept finally is reached. In addition, the principle in the decision matrices is that all of the team members be. Otherwise, some criteria might be missing from the screening matric. The strength of using Pugh Chart is that subjective opinions about one alternative versus another can be made more objective (Pugh, 1990). The second advantage of this method is that complexity and sensitivity can be performed and understood during the scoring process. In Figure 9, the criteria are developed after and during the evaluation process.

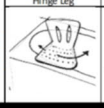
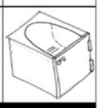
	DATUM	OPTION 1	OPTION2	OPTION 3	OPTION 4
	Swivel Chair w/ Hinge Leg	Hydraulic Swivel Chair	Pivoting Tub	Shower Grips	Tub Door
Sketches					
CRITERIA					
Aesthetics	DATUM	0	-	+	+
Cost (low preferred)		-	-	+	0
Ease of installation		0	-	+	-
Safety in use		0	-	-	+
Ease of getting in and out of tub		+	0	-	0
Intuitive use		0	-	+	0
Ease of maintenance		-	-	+	0
Bathing comfort (ability to relax and lay in bath)		0	+	+	0
Noise		-	-	0	0
Space required		0	-	+	+
Universal		0	-	+	0
Total +	0	1	1	8	3
Total 0	0	7	1	1	7
Total -	0	3	9	2	1
TOTAL	0	-2	-8	6	2

Figure 11. The example of the Pugh Concept selection method (Karl, 2003, P124).

Concept Scoring

Concept scoring is also one of the decision matrices in order to make the design decisions. Table 1 has well-illustrated how the scoring matrix used in this stage. Different from the example in concept screening, here is the weighted score in each concept in terms of different specific criteria. In addition, the use of hierarchical relations is a useful way to illustrate the criteria. After the criteria are entered, the team adds importance weights to the matrix. There are different means to adding the weights. In table 1, it assigns an importance value from 1 to 5 and allocate 100 percentage points among different categories.

Table 1. The concept scoring matrix example (Karl, 2003, P126).

Selection criteria	Weights	Concepts							
		A (Master Cylinder)		DF (Level Stop)		E (Swash Ring)		G+ (Dial Screw+)	
		Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Ease of handling	5%	2	0,1	3	0,15	3	0,15	4	0,2
Ease of use	15%	2	0,3	5	0,75	4	0,6	3	0,45
Readability of settings	10%	2	0,2	3	0,3	5	0,5	2	0,2
Dose metering accuracy	25%	3	0,75	5	1,25	2	0,5	3	0,75
Durability	15%	3	0,45	5	0,75	4	0,6	3	0,45
Ease of manufacture	20%	4	0,8	5	1	2	0,4	5	1
Portability	10%	3	0,3	3	0,3	3	0,3	3	0.3
Total Score		2.9		4.5		3.05		3.35	
Rank		4		1		3		2	
Continue		No		Develop		No		No	

2.2 Complexity of Organizational Communication

In this section, it reveals the complexity of organizational communication. It starts with the understanding of human communication studies, which consists its definition, and development. Then it introduces the organizational communication studies to further understand the role of each people in an organization and the organizational objectives. In the last, the pitfalls in Organizational Communication illustrates the three common pitfalls in organizational communication: information overload, distortion, and ambiguity.

2.2.1 Human Communication Studies

Communication is one of those human activities that everyone recognizes but few can define satisfactorily due to the different emphasis on the different communicators in a various context and means of communication. In the dictionary, communication is defined as below:

> ***Communication*** ***noun*** *com·mu·ni·ca·tion | \kə-ˌmyü-nə-ˈkā-shən*
>
> *A process by which information is exchanged between individuals through a common system of symbols, signs, or behavior.*

In this definition, it is explained as a process, and information is exchanged between individuals by a common system during the process. When it comes to human communication, the individuals are the people, and a common system could be verbal and nonverbal means, etc. Hence, it comes to a widely accepted definition among the human communication studies by Kreps (1986), which communication is defined as the process of **"sending"** and **"receiving"** messages between two or more people through verbal or nonverbal means (Kreps, 1986, p10).

Furthermore, communication process is always conducted with objectives and purpose. The information-transfer approach views communication as a metaphoric pipeline through which information flows from one person to another (Eisenberg, Goodall & Trethewey, 2007, p26). Steven Axley (1984) has brought up this version of communication theory on the following assumptions:

1. Language is capable of transferring thoughts and feelings from one person to another person.
2. Speakers and writers insert thoughts and feelings into words.
3. Words contain those thoughts and feelings.
4. Listeners or readers extract those thoughts and feelings from the words.

This view, popularized in the early to mid-1900s, compared human communication to the flow of information over a telegraph or telephone wire. According to this perspective, miscommunication occurs only when no message is received or when the message that is received is not what the sender intended. There are typical communication problems such as overload, distortion, and ambiguity. The information overload occurs when the receiver become overwhelmed by the information that must be processed; Distortion refers to the effects of noise on the receiver's ability to process the message; Ambiguity occurs when multiple interpretations of a message cloud the sender's intended meaning (David, 1960). The SMCR model of the information-transfer has been introduced by David Berlo (1960). To be specific, communication occurs when a sender (S) transmits a message (M) through a channel (C) to a receiver (R). The sender "encodes" an intended meaning into words, and the receiver "decodes" the message when it is received.

However, the critics of the information-transfer approach argue that it is simplistic and incomplete, painting a picture of communication as a sequential process (i.e. "I throw you a message, then you throw one back"). In addition, the model assumes that the receiver remains passive and is uninvolved in constructing the meaning of the message (Eisenberg, Goodall & Trethewey, 2007, p27).

Therefore, Wenberg and Wilmot (1973) have pointed out "all people are engaged in sending (encoding) and receiving (decoding) messages simultaneously. Each person is constantly sharing in the encoding and decoding processes, and each person is affecting the other". The transactional-process approach highlights the importance of feedback, or information about how a message is received, and particularly nonverbal feedback (Eisenberg, Goodall & Trethewey, 2007). The importance of nonverbal communication is captured by the famous axiom "you cannot communicate" (Watzlawick, Beavin, & Jackson, 1967, p. 49). In other words, a person need not speak to communicate; nonverbal messages are conveyed through a person's silence, facial expressions, body posture, and gestures. As a result, then, any type of behavior is a potential message (Redding, 1972).

Differing from the information-transfer approach in terms of the presumed location of the meaning of the message, the transactional-process model rejects this idea in favor of one in which meanings are in people, not words (Richards, 1936). It focuses on the person receiving the message and on how the receiver constructs the meaning of that message. In addition, the transactional-process model may be applied to the leadership study in the organization. Leadership involves a transaction between leaders and followers. Thus, successful leaders can shape the meanings that followers assigned to

what leaders say or do. The transactional-process model predicts that a common understanding will emerge between a leader and his or her followers over time through communication.

Unlike the transactional-process model, which assumes that effective communicators are clear and open in their efforts to promote understanding and shared meaning, the strategy-control perspective regards communication as a tool for controlling environment (Parks, 1982). The strategic-control approach to communication recognizes that while people may have reasons for their behavior, they cannot be expected to communicate in ways that consistently maximize others' understanding (Eisenberg, Goodall & Trethewey, 2007, p28). Communicative choices are socially, politically, and ethically motivated. Furthermore, we all recognize that others may violate the communicative expectations of clarity and honesty when they believe it is in their interest to do so.

Since the later 1960s, the central focus of social theorists has been the relationship between the individuals and society or organizations, within which the individuals are molded, controlled, ordered, and shaped by society and social institutions, and individuals also create society and social institutions (Wentworth, 1980, p.40). The approach of communication as a balance of creativity and constraint is the moment-to-moment working out of the tensions between the need to maintain order (constraint) and the need to promote changes (creativity) (Eisenberg, Goodall & Trethewey, 2007, p28). As such in the Figure 10, communication is the material manifestation of the institutional constraints, creative potential, and contexts of interpretation.

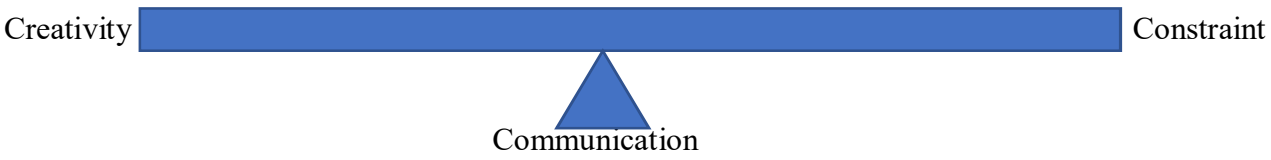


Figure 12. An illustration of the communication as a balance of creativity and constraint (Eisenberg, Goodall & Trethewey, 2007, p28).

2.2.2 Organizational Communication

After examining the different concepts in communication, organizational communication becomes easy to define. There are two common perspectives about organizational communications due to the fact that organizational communication involves in the intersection of two complex concepts organization and communication (Koschmann, 2012).

In the first perspective, organization is seen as a container, where communication flows (Koschmann, 2012). The organization need to communicate the right information to the right people at the right times and in the right ways (Krippendorff, 1993, p3). It empathizes the communication inside the organizations. However, in the second perspective, communication is seen as the fundamental process that shapes our organization and sociality (Koschmann, 2012). And organization is created by people with different values, motivations, abilities, resources, etc (Miller, 2008). It emphasizes the communication between different organizations.

In addition, it has been articulated by Miller (2008) that most scholars would agree that "organizations" are social collectives, embedded in a larger environment, in which activities are coordinated to achieve individual and collective goals. The organization has been defined as an entity comprising multiple people, such as an institution or an association, which has a collective goal and is linked to an external environment (Chandra, Das & Ramesh, 2016). Then, while collaborating with diverse others is unavoidable in organization, the question is how we collaborate with each other. It has been brought up by many organizational communication scholars that the communication happens within organization (Koschmann, 2012).

To review the high points of organizational communication theories – communication as information transfer, transactional process, strategic control, and a balance of creativity and constraint, the approaches are evolving and complementing with each other to have a more reasonable and practical definitions and understandings about the organizational communication. A summary of the perspectives appears in Table 3.

Table 2. Four Preliminary Organization Communication Perspectives (Eisenberg, Goodall & Tretheway, 2006, p35).

	Organization Communication: Preliminary Perspectives			
Metaphor	Communication as information transfer	Communication as transactional process	Communication as strategic control	Communication as a balance of creativity and constraint
Assumptions	1.Language transfers thoughts and feelings from	1. There are rarely clear distinctions	Strategic ambiguity gains control because it	All communication accomplishes two

	person to person; 2. Speakers and writers insert thoughts and feelings into words; 3. words contain the thoughts and feelings; 4. listeners or readers extract the thoughts and feelings from the words.	between senders and receivers; 2. Nonverbal feedback accompanies or substitutes for verbal messages; 3. Meanings are in people, not words.	1) promotes unified diversity, 2) preserve privileged positions 3) is deniable 4) facilitates organizational change.	things at once: It reflects historical constraints of prior contexts, and it represents individuals' attempts to do something new and creative. This is the duality of social or organizational structure.
Description	Sources transmits a message through a channel (air or light) to a receiver; communication is a tool people use to accomplish objectives.	Person receiving the message constructs its meaning; the idea is for senders to adapt their messages to the needs and expectations of their listeners.	Strategic ambiguity takes advantage of the diversity of meaning s people often give to the same messages; choices of what to say are socially, politically, and ethically motivated; strategies can be selected to accomplish multiple goals.	Communication is the moment-to-moment working out of the tension between individual creativity and organizational constraint. Approaching organizations as constructed through communication requires simultaneous attention to the ways in which groups of people both maintain order through their

				interactions, nd allow individual actors the freedom to accomplish their goals.
Measure of effectiveness	Receiver of communication understands what the speaker intended	Shared meaning	Coordinated actions accomplished through diverse interpretations of meanings	A balance between satisfied individuals and a coherent community
Limitations	1.Overly simplifies communication: Treats transmission of the message as linear and unproblematic; 2. Sees the receiver as a passive receptor uninvolved with the construction of the meaning of the message; 3. Does not account for differences in interpretation between speaker and listeners	1. Emphasis on shared meaning is problematic and ultimately unverifiable; 2. Bias towards clarity and openness denies political realities; 3 does not account for ambiguity, deception, or diversity in points of view.	1. Can minimize the importance of ethics; 2. Places strong emphasis on individuals over communities; 3. Overemphasized the role and power of individuals to create meaning through communication.	Can sometimes be difficult to identify what counts as as constraint; also tends to draw attention away from materials economics realties that may threaten system independent of member behaviors.

2.2.3 Complexities and Challenges in Organizational Communication

After reviewing the definitions and developments in communication and organizational communication, it helps us to define the different pitfalls in organizational communications. There

are three most pitfalls in the organizational communication**: information overload, distortion, and ambiguity.**

Information overload is one of the typical failures of an organization's information processing. According to Schneider, S. C. (1987, p143-153), a model of information overload is presented that describes the antecedents (the nature of information and organizational conditions) and consequences (primary and secondary symptoms). To be more specific, Information overload occurs when the amount of input to a system exceeds its processing capacity, and people may not be able to fully "encode" or "decode" the message consistently in the organizational communication (Roberts & O'Reilly III, 1974). In the organizational communication, a good example of information overload is that people have problems in talking and communicating with each other during a nosey environment, where everybody is talking but couldn't listen to one specific opinion.

In the definition of communication as information transfer, information distortion means changes in the meaning of a message as the message passes through a series of senders and receivers (Ehrle, 1973). A good example is that people may include their emotions in the talking when people in the team having an argument on some specific topic, which influences the listeners judgement even though it is right objectively. The good solution of avoiding information distortion is trying to be objective and factual as passible instead of getting too much subjective emotions and opinions (Huber, 1982).

The information ambiguity refers to the definition of communication as a strategy control. Communicators must be able to recognize the constraints of the situation and to adapt to multiple goals simultaneously, such as being clear, assertive, and respectful of the other person (Tracy & Eisenberg, 1984). The information ambiguity can also be called as strategic ambiguity in organizational communication, which is an important concept that describes the ways in which people may communicate unclearly but still accomplish their goals (Tracy & Eisenberg, 1984). While common sense may dictate that effective communication should be always clear, there are several instances in organizational life ambiguous messages may be productively deployed. Specifically, strategic ambiguity can promote unified diversity by taking advantage of the diverse meanings that different people can give to the same message. Secondly, strategic ambiguity can preserve privileged positions by shielding those with power from close scrutiny by others. Thirdly, strategic ambiguity can facilitate organizational change by allowing people the interpretive room to change their activities while appearing to keep those activities consistent. Finally, by being less than precise, employees can

protect confidentiality, avoid conflict, and conceal key information that may afford them a competitive advantage (Eisenberg, Goodall & Trethewey, 2007). In this sense, strategic ambiguity is also said to be deniable.

2.3 Communication in Teams

Simply calling a "team" does not make it one. Eisenberg, Goodall & Trethewey (2007, p243) have asserted that a group of teams though the kinds of communication it displays over time and the resulting feelings of trust and interdependence, and five communicative elements of team interaction that are essential to consider: roles, norms, decision-making processes, management of conflict and consensus, and cultural diversity. In addition, there are in general three types of team-based organization: project teams, work teams, and quality-improvement teams. A team-based organization is one that has restructured itself around interdependent decision-making groups, not individuals, as a means of improving work processes and providing better quality and service to customers. Also, depending on the location of its members, any of these types of teams may be classified as a virtual team.

2.3.1 Different Types of Teams

Project teams

Project teams, which help coordinate the successful completion of a particular project such as the design and development of new products and services. Typically, people are from different backgrounds in the project team, which make it even harder to collaborate across significant functional divides. Management must actively work to build real collaboration, by increasing commitment to team decisions, and to demonstrate a deep caring about team outcomes and accomplishments. A good project team practice is that people within the team are always reported with a matrix, which can help the people in the project team understand each person's role. In the "matrix" organization, people's previous expertise and experiences are the judgement where this person should work on in the project work.

Work teams

A work team is a group of employees responsible for the entire work process that delivers a product or service to a customer. Successful work teams are supported by a commitment to empowerment, because they are given the discretion and autonomy to make decisions and solve problems, empowered teams are not frustrated by a lack of authority to implement their ideas and solutions (Eisenberg, Goodall & Trethewey, 2007, p243). More generally, a group can do a better job of managing its resources when it understands the big picture, has Iity to adapt to changing work conditions, and feels that its work is meaningful and has an impact (Churchman & Rosen, 1990). A big difference between the work teams and the other teams is the rewarding system in the work teams, which normally distributed according to the contributions of both the team and its individual members. The key in the work teams is how to evaluate and reward teams whose members contribute unequally. In addition, due to the emphasis on the rules of taking care of own "territory", the team members lack of collaboration between each other. There is also a big concern about the management of the work team, which sometimes resist the move to empower self-directed work teams (Tjosvold & Tjosvold, 1991). It requires the supervisor overseeing a team to create a climate for honest and supportive dialogue and possess the necessary communication skills to do so.

Virtual Teams

A superficial analysis of virtual teams can identify likely problems to watch out for, such as language barriers and differences in cultures, religions, work customs, and work habits. But deeper consideration reveals that all virtual teams engage in a developmental process that builds a negotiated order – a shared set of practices or "micro-cultures" that emerge among members (Gluesing, 1998). The virtual team is more defined under the current globalization and digitalization trend, which makes the teams more international and diverse. Future studies of virtual teams will no doubt shed more light on the programmatic of succeeding with the new organizational form. One important influence may impact communication among virtual team members.

When examining our work environments, we foster organizations that encourage individual competitions but rely on group efforts and cooperation. Both sides unchecked can lead to extremism and imbalance. Is there a middle ground? The combination of cooperation and competition creates a synergistic model of co-opetition, a term coined by Raymond John "Ray" Noorda, the CEO of Novell between 1982 and 1994. Within the Small-Group Communication setting, co-opetition has been defined as the need for every person to contribute their individual best to the collective (Perkins, P. S., 2008). People can recognize co-opetition in the workplace because members of the organizational culture begin to own the experience they are having, which means they are more aware of their self-

affirming and climate supportive. It also requires the team to foster institutions that create collective merit systems that recognize the contributions of the whole group on a project. Too often we singled out individuals when behind them stood a number of others who helped to carry the torch. In a contest, we did need competition which is good for individuals to also stimulate the people's capability and potential. However, we have to keep in mind: too much of anything aren't a good thing.

2.3.2 Making Room for the Group Reality

Small-Group Communication requires a broadening of our communication abilities to include three or more perspectives, all operating from different perspectives, which are often assumed to be compatible (Perkins, 2008). The need to make room for the other person's reality is magnified within the small-group dynamic because most individuals have perceived and already solved the problem based on their personal reality and personal needs. For better or for worse, the hyper-individualistic culture we live in propagates a whole culture of people very adept at surface communication, conflict avoidance, and adopting passive-aggressive types of defense mechanisms. In general, we have been taught to compete with one another more than we are taught to work together for the greater good. The desire to achieve a pat on the back often propagates self-centered ambitions, which is often compounded by the atmosphere of competition most workers thrive in. However, in spite of all the individualistic competition, we manage to maintain the institution and find someone who are able to do this through the vision and abilities of those who lead their teams to a unified objective, realizing there is no "I" in team.

Increasingly, the dynamic of global village and global economy create interesting challenges for doing business worldwide. The question is why some individuals are extremely successful within the corporate or institutional dynamic while others appear to be stagnant, with no apparent vested interest. The answer is that the leaders (who we see more successful) have a fundamental understanding that effective communication practices are the keys to a successful organization, which greatly affect their decision-making skills. The more points of view that have to be considered in the discussion, the greater the need for problem-solving and conflict management skills (Perkins, 2008, p98). In many people' past resolutions, they tend to have only-one-can-be-the-victor attitude which causes the aggressive, win-lose patterns of resolution. How can we harmony within our institutions or teams? The key is to learn "getting along" by setting aside personal points of view long enough to make room for the fact that there is always more than one way to approach any discussions and solutions. As

within the interpersonal dynamic, critical listening and thinking skills are paramount to group communication.

2.3.3 Leadership & Communication Climates

Regardless of other elements of the teams, success of the teams lies solidly on the backs of those in leadership positions charged with the mandate to get the job done with more responsibility than the other team members. The organizational leader must know and work to advance the team and offer a more unifying approach as to how communication functions on all levels-internally and externally (Perkins, 2008, p99). Too often those who lead organizations have not done the necessary homework to make sure their communication ability and usage are not damaging to those they are trying to lead. Therefore, organizations and groups need varying leadership styles. In addition, there are groups that function more productively in democratic leadership environments. These organizations feel it necessary to allow most members to know they have a recognized individual contribution.

In spite of the type of leadership mandated by your organization or group, you need to be prepared for the communication responsibility and expertise required to be an effective leader. Becoming aware of your communication styles and request feedback to assess this vital area of leadership. Using the intent-drive and esteem-building language is needed to replace communication that is toxic and ego damaging such as in the Table 4.

Table 3. Examples of intent-driven and supportive communication (Perkins, 2008, p100).

INTENT DRIVE	**ESTEEM BUILDING**
The organization will meet its goals of…	Communication as equals
employer and employees are working together	Proactive conflict resolution
We are a team of mutiple perspectives with common goals…	Consistent praise
our work together has furthered	Direct, clear feedback
We will accomplish…	Descriptive, I/We versus you

Accepting the privileges and challenges of being a good leader requires that we use our communication expertise to always encourage productive, passion-filled organizational environments. Your thoughts, words, and actions create and support the leadership identity you determine (Perkins, 2008, p100).

Within the organizational dynamic, we have formal and informal communication networks, which allows both structured and unstructured flow of communication, from management to labor, labor to management, coworker to coworker, and company to client. It has been defined by Perkins (2008, p102) that formal structures include the company's policies, rules, tracking systems, evaluation processes, complaint processes, and all other aspects of communication as formally mandated through company policy while the informal structures are those that exit without benefit of policy, but they have just as much to do with the communication dynamics of the organization as the formal structures. For instance, the discussion in the break room or cafeteria, at the water cooler or company picnic, and so on, is typical of informal structure. Those gossips exchanged in the informal structure communication will help to clarify what really went on behind the closed doors, the chat with a colleague who can help you expedite some red tape.

Any wise manager realizes that informal communication is just as important to the organizational dynamic as formal communication. A good analogy is often used to describe the informal communication acts as the "central nervous system" of the organization. Moreover, there is a constant interplay between the areas of formal and informal networks. As a result, both of these vital areas within the organization should be taken into account. It has been found by conducting communication audits within an organization that information flowing from informal networks can positively or adversely affect the organizational context, especially the networks, impacting relationships, morale, and productivity.

There are patterns of communication that will support your group communications in a more productive manner than another pattern in Figure 11 might in terms of the formal and informal flow of communication, which also reflects on how individuals receive and use the information shared. Top down is the typical organizational hierarchical pattern, which facilities more to the formal communication patterns such as board of directors, president, VPs, managers, and on down, all vertical. The forward pattern moves communication along a designed, formal line of information sharing, which carries the organization horizontally. Then the circle pattern broadens the outreach by widening the table of those allowed to participate, which trends more toward the informal, but is somehow closed. The social pattern is an open, active network of exchange generally utilized for informal, social group discussions. It is important that the organization be aware of the various patterns of group communication and how these can function to advance the aim of effective communication (Perkins, 2008, p104). Most of cases, those patterns happen in the organization spontaneously and simultaneously. But it also can be manipulated somehow with intentions,

especially for the formal communication part by setting new rules in the organization under the leadership or management group. Therefore, choosing the appropriate communication pattern for a specific group experience can help facilitate positive group communication efforts.

Figure 13. Organizational Communication Patterns (Perkins, 2008, p104).

2.3.4 Team Conflict

Team conflict refers to an interpersonal problem occurs between two or more members of a team and affects the results of teamwork. Team conflict is mainly caused by the situation when the team members with different perceptions, values, goals, etc. cannot agree with each other and are upset about each other. Furthermore, Researcher Thomas K. Capozzoli (1995) has classified team conflict into constructive conflict and destructive conflict.

It has been mentioned by Thomas (1995) that conflicts are constructive when people change and grow personally from the conflict. When the conflicts involve more and more people, the conflicts usually become a group discussion with the purpose of finding a solution to a problem. The constructive conflicts usually happen to the conflicts over positions, strategies and opinions. For instance, the sales manager decided to sell the products despite the disagreements of the other sales team members. The constructive approach in this conflict is to exchange the opinions between the managers and the members in order to understand two sides' considerations and make a more considerable decision.

It is studied by Thomas (1995) that conflicts are destructive when no decision is reached. When a team conflict remains unsettled, it results in the lower efficiency of the teamwork. And gradually the team becomes divided. The destructive conflicts happen due to the personality clashes, mistrust and uneven communication. For instance, two persons in the team have very different personality style and are always against each other, and they always stand for different opinions no matter what. In this case, it becomes a destructive conflict which leads to the failure of the teamwork. To improve

this type of conflicts, the manager or leader in that team need to equip the team members the knowledge of MBTI personality test and make each other understand each other more.

2.3.5 Conflict Resolution in Teams

The team conflict resolution is defined as communication between the involved groups (Forsyth, 2009). In order to understand the conflict resolution, we need to understand the basic of intrapersonal and interpersonal communication and how they are related with team conflicts (Perkins, 2008, p55).

People's self-esteem (how people feel about themselves) and their self-worth (the value you place on yourself in comparison to others) come from the depth of these experiences, which determines sometimes how they act in front of other team members. In a team conflict, it has been suggested for all the members to reflect on themselves what they are trying to communication and how they are communicating (Perkins, 2008, p56). In many cases, people often include their subjective opinions on something else into the teamwork instead of presenting the facts, which causes the team conflicts. Furthermore, those opinions mentioned above may develop into personal judgements based on people (Perkins, 2008, p56).

It has been defined by Graziano, Jensen-Campbell & Hair (1996) that interpersonal conflicts occurs when a person or group of people frustrates or interferes with another person's efforts at achieving a goal, which contains three different components: behavioral components, cognitive component, and affective component. The behavioral component involves someone interfering with the objectives of another person. The cognitive component involves a disagreement between the parties that illustrates the differences between the interests and objectives of the conflicting parties. The affective component interferes with each party.

Therefore, it is vital in the team to encourage supportive and productive interpersonal relationships. In real life, we all want to feel valued and respected, which also adapt in the teamwork. Since we know the conflicts in team are normal and can even be constructive, the question becomes how we handle conflict. It has been suggested by Perkins (2008, p75) that we have to be aware of how much our ego plays a role in creating conflict. After that, the ***supportive communication*** versus ***defensive communication*** helps individuals understand that communication in a particular manner is more productive and will benefit the outcome they seek. Here are the examples of the difference between the types of patterns in Table 5:

Table 4. The different types of supportive and defensive communication (Perkins, 2008, p75).

Supportive communication	Defensive communication
Problem-centered	Blame-centered
Cooperative	Competitive
Uses descriptive "I"	Uses accusative "You"
Open to different perspectives	Egotistical
Compassionate	Self-centered

It has also been suggested by many observations that many conflicts are a matter of individuals trying to prove they are tight and consistently seeking to confirm that rightness no matter what. It is very unwise to think that others see things exactly the way you do. In order to make crate a shared, loving interpersonal relationship, it is vital to make room for the other person's reality, which also helps to engage in communication practices that respectfully acknowledge the individual worth of a person and the person's right to their own perspective while affirming your right to the way you are experiencing the situation.

It is also called a constant state of empathy, or a feeling into. Therefore, empathetic listening is recommended as an effective way to make rooms for the others. It is vital to have active listening in order to have a coherent and smooth-functioning organization. Of the four types of communication experiences people engaged in daily, listening is practiced more than the other three (writing, speaking, and reading). Listening is also called the silence of healer, which requires four basic human elements: mind, ears, eyes, and memory, with all four working simultaneously to receive maximum input (Perkins, 2008, p79). Mind is defined as the world of intellect and emotion housed in the brain. The eyes reveal the true intent of an individual's behavior, motive, and feelings. Memory is what people rely on most in the listening experience, which compares to the computer chips that drives the daily awareness of your surroundings. Ears perform as a physiological function in the listening experience. In order to have a better understanding about the listening behavior, there are many listening experiences analyzed compared to the non-listening behaviors on the Table 6.

Table 5 Listening behaviors VS Non-listening behaviors.

Listening behaviors	Non-listening behaviors
• Looking directly at the speaker	• Consistently looking away from the speaker

• Body is facing the speaker • Using responsive Nonverbal Communication • Maintaining an open, pleasant facial expression • Reducing intrapersonal noise • Tracking main points • Using your eyes, ears, mind, and memory	• Allowing intrapersonal noise to take over (daydreaming) • Interrupting • Paying attention to mental and physical distractions and environment • Fidgeting • Non-expressive face and body • Reading, watching TV, and other distractions • Paying attention to the speaker's vocal or physical limitations instead of the message

Keeping our listening skills tuned up is important in our daily life, because our families, our jobs, our social commitments rely on our ability to be truly present. We must learn to listen mentally and physically and involve the senses in the listening experience. You cannot make room for another person's reality if you do not listen. Nor can you be an effective communicator. Conflict brings creativity and helps avoid groupthink. However, too much conflict can stop teams for doing their work (Guffey, Rhodes & Rogin, 2010). In the end, as a result of your intrapersonal health, your nonverbal awareness, and your interpersonal skills, you can move more comfortably confidently onto the next steps of cross-culture communication.

2.4 **Intercultural Communication**

In this section, we will introduce the idea of organizations as cultures. Cross-cultural communication, which is also referred to as inter-cultural communication, has been defined by Perkins (2008, p163) that as "a communication between individuals or groups from different cultural backgrounds whose diversity of symbol systems and cultural perspectives influences that communication exchange". The cultural approach brings a new focus on the culture elements, Hofstede's cultural dimensions theory, language of the workplace, and three views of organizational culture.

Cross-culture communication is also known as the highest art and science of human communication, and it is a one of the critical parts of all the communication skills and knowledge. Acquiring communication knowledge and skills will enhance confident and comfortable communication across

different cultures (Perkins, 2008, p155). Here are more detailed explanations about the cross-cultural communication in the organizations.

2.4.1 Cultural Elements

Cultural Element is defined by Pacanowsky & O'Dnnel-Trujillo (1993) as symbolic expression when organizational cultures emerge from the organizational members' individual and collective symbolic expressions. One thing we have to keep in mind is that the culture symbolic expressions are not determined, which are always seen as stereotypes on one specific culture. Instead, the symbolic expressions are always changing and evolving, and of course not determined by on small group of people under this culture. Given by the definition of cross-culture communication, culture elements during the cross-culture communication are made up of two major pars, which are Verbal elements and Nonverbal elements (Ferraro, 2006).

Verbal Elements – Language

Nearly 80 percent communication takes place through language with constant evolvement. However, it may be very difficult in some cases. For instance, when an English native speaker attempts to communicate with people who do not speak English, one's chance for miscommunication increase enormously (Ferraro, 2006). Different from the other specials on earth, we human beings have the ability to build our own symbolic linguistic system. Therefore, language allows human to transcend many of their biological limitations by building cultural models and transmitting them from generation to generation (Ferraro, 2006). See on the Table 7, it has shown the top 10 most used language in the word in terms of numbers of first-language speakers. Though, we have to keep in mind, nowadays the English can be seen as part of international language with more and more people knows and speak some due to the western developed countries are going globally and internationally with their movies, sciences, products, business activities, and so on. If you want to communicate effectively in the cross-culture communication, there is no substitute of the hard work it takes to learn a language (Ferraro, 2006).

Table 6. Major Language of the World (Janssen, 2017, p626).

Language	Primary Country	Number of First-language Speakers (in million)
1.Mandarin	China	874
2.Hindi	India	366

3.Englsih	India	341
4. Spanish	Spanish	322
5. Bengali	Bangladesh	207
6.portuguese	Portugal/Brazil	176
7.russian	Russia	167
8.japanese	Japan	125
9.german	Germany	100
10.korean	Korea	78

As it can be noticed that the language and culture have the most obvious relationship, how the culture influences on culture, and language influences on culture are the researched questions. For instance, the most recognizable relationship between language and culture is seen in vocabularies. After the industrialization, it can be noticed in the English vocabularies that contains a lot of complex technology terms from US. Thus, the language is always evolving, and people need to be aware of the new languages. On the other side, language is not only for communication but also help us to distinguish different things and objectives (Ferraro, 2006).

Nonverbal Elements

The nonverbal element of communication refers to the "silent language" taking place through nonverbal communication (Edward, 1959). In the enormous range of nonverbal expression studies, Edward (2006, p77) has found two phenomena: 1. different nonverbal cues carry same meanings in different cultures; 2. the same nonverbal cues might carry different meanings in different cultures. Eisenberg & Smith (1971) and Condon & Yousef (1975, 123-24) has categized 24 nonverbal elements, and there are 16 main nonverbal elements showing below.

- Space usage (proxemics)
- Hairstyles
- Cosmetics
- Facial Expressions (smiles, frowns)
- Touching
- Eye contact
- Olfaction (scents or smells, such as perfume)
- Hand gestures
- Walking (gait)

- Posture
- Time symbolism
- Graphic symbols
- Silence
- Color symbolism
- Artifacts (jewelry, fly whisks, lapel pins)
- Clothing

The basic knowledge about their nonverbal manners among the categories are recommended in the cross-culture communication. For instance, in Japan, people are bowing to each other and always show great respect to the elders and seniors. In contract, people in Spain, Italy, France or some other western European countries are always kissing each other's chess to show respect and greeting. Furthermore, the consequences of misunderstanding nonverbal cues are not always catastrophic especially in the beginning of the cross-culture communication, and people are always tolerant to those the unmeant misunderstanding (Edward, 2006). On the other hand, they appreciate the strangers' desire or curiosity on their culture. Besides, when meeting up with a foreigner, the local people are normally more tolerant in terms of some traditional etiquettes and nonverbal categories and forgive their wrongdoing behaviors.

In the end, though the language and nonverbal communication are always separated, they are always interconnected. It is advisable to understand both the spoken and nonverbal language, which will increase the success in the cross-culture communication (Ferraro, 2006, p97). Thus, it is recommended to learn both the spoken language and the nonverbal behavior in order to have a successful cross-culture communication.

2.4.2 Hofstede's Cultural Dimensions Theory

Hofstede's cultural dimensions theory is a framework for cross-cultural communication studies, developed by Dutch social scientist Geert Hofstede (1980). It describes the effects of a society's culture on the values of its members, and how these values relate to behavior, by using a structure derived from factor analysis. After the development of other scholars, Hofstede's Cultural Dimensions Theory derives into six most used dimensions, which is also widely known as 6-D models of national culture: Individualism-Collectivism; Uncertainty Avoidance; Power Distance; Masculinity-Femininity; Long Term Orientation; Indulgence. Furthermore, the clear patterns of similarity and difference along the dimensions have been defined as following patterns in Table 8.

1. Power Distance Index (high vs low) (PDI)
2. Individualism VS Collectivism (IDV)
3. Masculinity VS Femininity (MAS)
4. Uncertainty Avoidance Index (high vs low) (UAI)
5. Pragmatic VS Normative (PRN)
6. Indulgence VS Restraint (IVR)

Table 7. Cultural Influences on Global Virtual Teams (Ferraro, 2006, p10).

Variables	Personalities	Tips
High PDI	• Centralized management. • Different hierarchies. • Need more respects.	• Listen to the leaders and trust the authorities. • Don't go beyond the hierarchies.
Low PDI	• Flat management. • Managers are equal to normal employees.	• Delegate as much as possible. • Ideally, involve all those in decision making who will be directly affected by the decision.
High IDV	• High value placed on people's time. • An enjoyment of challenges, and an expectation of individual rewards for hard work. • Respect for privacy.	• Understand the individual accomplishments. • Don't mix work life with social life too much. • Encourage debate and expression of people's own ideas.
Low IDV	• Focuses on building skills and becoming master of something. • People work for intrinsic rewards. • Maintaining harmony among group members.	• Suppress feelings and emotions that may endanger harmony. • Avoid giving negative feedback in public.
High MAS	• Strong egos – Pride of achievements. • Like competitions.	• Different genders have different roles. • Understand the risks and opportunities. • Need more motivation.
Low MAS	• Relationship oriented/consensual. • Enjoy life more. • No Gender differences.	• Involve more negotiations and discussions • Be young. • More flexible. .
High UAI	• People are expressive, and are allowed to show anger or emotions, if necessary.	• Know to respect the structures.
Low UAI	• Very inclusive and willing to change and be innovative.	• Know to respect the structures.
Pragmatic	• People are okay with ambiguity.	• Try to make things clear a bit.

Normative	• People are not okay with ambiguity.	• Try to leave some space to people, not promise too much.
High Indulgence	• Very optimistic	• Be flexible and focus on future more.
High Restraint	• Pessimistic.	• Focus on reality more.

2.4.3 Cross-cultural Communication in Teamwork

Barriers to Cross-cultural Communication

In many experiences, face-to-face communication is not perfect, and it can also lead to misunderstanding and even conflicts in cross-cultural communication (Guirdham, 2005, p179). In order to figure out the barriers to cross-cultural communication, we have to first understand the term "miscommunication". It has been defined by Guirdham (2005, p180) that the receiver misunderstands the message. In a way, the miscommunication comes from the gap between the speaker's meaning and the receiver's understanding of the meaning.

As we have understood the definition of miscommunication, the general problem of intergroup communication, stereotyping and prejudice are the most likely reason for the misunderstanding according to Roger & Kincaid (1981). In the intergroup communication, people always start to "identify" the groups from the surroundings with or without intentions (Roger & Kincaid, 1981). In the stereotyping caused barriers. Stereotyping always leads people to have a prejudgment on people (Guirdham, 2005, p179). In prejudice communication barriers, prejudice may stand for the racism, sexism, homophobia and ageism, as well as religious to the other people (Guirdham, 2005, p188). And it has been noticed by many communication professionals that prejudice people tend to distort and misread the people whom they hold prejudice views.

Culture and Working Activities

As it has been illustrated in the previous section, culture differences exist. More importantly, it has effects on the working activities and group works. For instance, in the job interviewing, in the study it shows that Chinese applicants tend to defer to the interviewer (who is categorized as a superior in their culture) and to focus on the group or family, besides being averse to self-assertion (Wrong,

2000). There are two most relevant subjects within the working activities to this thesis research topic: Team Spirit, Leadership & Management.

Team Spirit refers to the feeling of pride and loyalty, which exists among the members of a team and makes them want their team to do well or to be the best in the Collins English Dictionary. Since people from different culture context have more different expectations in terms of the wiliness to cooperate as part of a team (lower wiliness vs higher wiliness), it will affect the teamwork outcomes and the effectiveness of the group work (Guirdham, 2005, p296). In particular, if the task requires a lot of co-ordination and diversity of values, the weak team spirit will decrease the group effectiveness. On the contrary, the strong tea m spirit will increase the effectiveness of group work.

In the Leadership & Management, Guirdham (2005, p188) has explained that culture affect the people' expectations from the leaders and their behaviors at the same time. A good example is that the woman in Muslim countries are not affirmed to be a leader or manager in the working activities, even it is very rare to see women work in Muslim countries. Furthermore, it has been articulated by Srivastava, Bartol & Locke (2006) that empowering leadership was positively related to both knowledge sharing and team efficiency, which, in turn, were both positively related to the team performance in most of cultures. Meanwhile, under the trend of globalization, it requires the leaders and managers to have a high level of cultural adaptability.

2.5 **Communication Tools**

As we already discussed in the previous section about the definition of the organizational communication and communication conflicts or barriers, communication tools are serving for the communication purpose. When reviewing the existing studies on the communication tools in the organizational communication context, it has focused on the technical part of the communication tools such as words, publications, videos, or websites, social media nowadays and so on, which has also been divided into traditional communication tools and online communication tools (Holtz, 2004).

2.5.1 Traditional Communication Tools

Most professional communicators enter the business because they are skilled at producing communication tools, such as words, publications, videos, or web sites. Human beings are hard-wired to send and receive communications in a face-to-face setting, especially for people who are separated from each other at a long distance. How to transfer the message immediately, and how to keep the

message complete are the main problems when human beings are evolving. Hence, without face to face component of communication, information recipients are left to interpret an incomplete message, one without facial expressions or tone of voice.

However, as people has faced a good need to transfer the message with each other, the words and letter in writing, mobile phone, emails, etc. have been invented to serve the purpose of exchange message with each other or even passing those messages to the next generation. It is so called communication tools. It has been categorized into the face-to-face communication tool, print, video by Holtz (2004).

In the face-to-face communication tool, leaders should talk to employees instead of reading to them. A leader who looks down and reads from a prepared text (probably not one that he or she even wrote) does not inspire that kind of allegiance. Also, it has been suggested to practice your talk before you deliver it whether it is before a large audience or with a single employee. A good example is the successful salesman who can practice their sixty-second elevator pitch. In addition, when engaged in Q&A, don't answer questions to which you don't know the answer. Many leaders believe they will look week and uninformed if they say, "I don't know." In conclusion, the face-to-face communication tools are not so many, but some tips are very helpful when especially you are in the leader position in the company or organization.

The print indeed has power as a communication tool. In fact, the research study by Watson Wyatt Worldwide, IABC, and the IABC Research Foundation found that ongoing print publications for all employees are the most effective media for in-depth and complex communication, according to 70 percent of the 913 organizations participating in the study. There are several key tips of using the print as a communication tool. Firstly, print should be portable as people tend to read those print wherever they want. We should prepare some easy-carry papers for the users to carry those. Secondly, the readability of the print is the key factor which affects people to actually read the print. To be more specific, the size of the text, the length of the text, the structure of the article are very critical in considering the readability of the print. In practice, there are some employee notifications, magazines and newsletter, which are widely and frequently used in the company's internal communication.

2.5.2 Online Communication Tools

As the internationalization is coming, people are spending more time on the digital world per day. Especially for the adolescents, who are heavy users of newer electronic communication forms such as instant messaging, email, and text messaging, as well as communication-orientated internet sites such as blogs, social networking, and sites for sharing photos and videos (Subrahmanyam & Greenfield, 2008). Also, due to the development of the internet technology, people can quickly send each other text, voice, video messages as they want, as well as having directly video chat. In order to have a complete understanding about the online communication tools, there are three main online communication tools as time goes by.

The first one is the very basic online communication tool such as email, email newsletter, text message, online publishes. It has greatly changed the way of people how to get the information in their daily life. People don't have to read from the papers or even watch the TVs. They can just use their laptop or smartphone to get access to the news. Inside the company or organization, we can find out that sending or reserving each other emails in the office becomes a regular work. Comparing to the print, the digital paper or news salves cost and can be transferred fast and on time. However, the problem with the digital news is the reducing credibility and junk information everywhere. We have been exposed to a larger information world with digital information comparing before. Hence, knowing how to find the right information becomes essential important. When it comes to communication, it means to send the right information to the right person.

The second one is the social media platform such as Facebook, Instagram, what's up, WeChat, etc. As social media moves from "buzz word" status to strategic tool, more practitioners are developing skills related to this online communication technology (Eyrich, Padman & Sweetser, 2008). People can easily get connected and interact with the others via social media, for instance, many companies are using Yammer (one of social networking service used for private communication within organizations) as their internal communication channels, where employees can exchange their ideas more freely without hierarchy concerns, especially when the company is large, which is hard for different apartment to communication with each other. Also, people can have their private social media. For instance, Instagram is where they can share some posts and moments to their added friends. It has helped the others to know what you are doing and busy for.

The last one is the online/web meeting, google shared doc, ppt, excel, etc. In the past few years, group work and collaboration using online environments has become an important research topic because of the interconnectivity enabled by the Internet, and more specifically, the World Wide Web (WWW) (Johnson, 2001). For instance, the online/web meeting can facilitate the group work wherever the group members are as long as the internet and laptop has been set up. People can see each other and communicate as they are in the same table and having face-to-face discussion. Another very helpful communication tool is the google shared doc, PPT, and excel nowadays, because people are always required to have some paperwork in a project. A shared doc or PPT or excel, editing and creating the content together, can really facilitate the teamwork instead of each person edited theirs and converge.

In conclusion, the online communication tools have indeed made a difference to the communication world. But it doesn't mean the traditional communications tools disappear from the current world. Both the traditional and online communication tools can exist at the same time. Even there are some studies which suggests the face-to-face communication can help to increase the communication skills while the online communication tools decreased this ability. For instance, although teens find valuable support and information on websites, they can also encounter racism and hate messages. Electronic communication may also be reinforcing peer communication at the expense of communication with parents, who may not be knowledgeable enough about their children's online activities on sites such as the enormously popular Myspace (Subrahmanyam & Greenfield, 2008).

2.6 **Theoretical Framework**

In this section, it does not only summarize the whole literate review, but also illustrates the relations between the literature review and the research question. The purpose of this framework is to guide the research process. As it mentioned earlier, the research question of this study is how to improve the organizational communication in team-based product design process, which involves the OC concepts, team studies, product design process studies. The theoretical framework is presented in Figure 12.

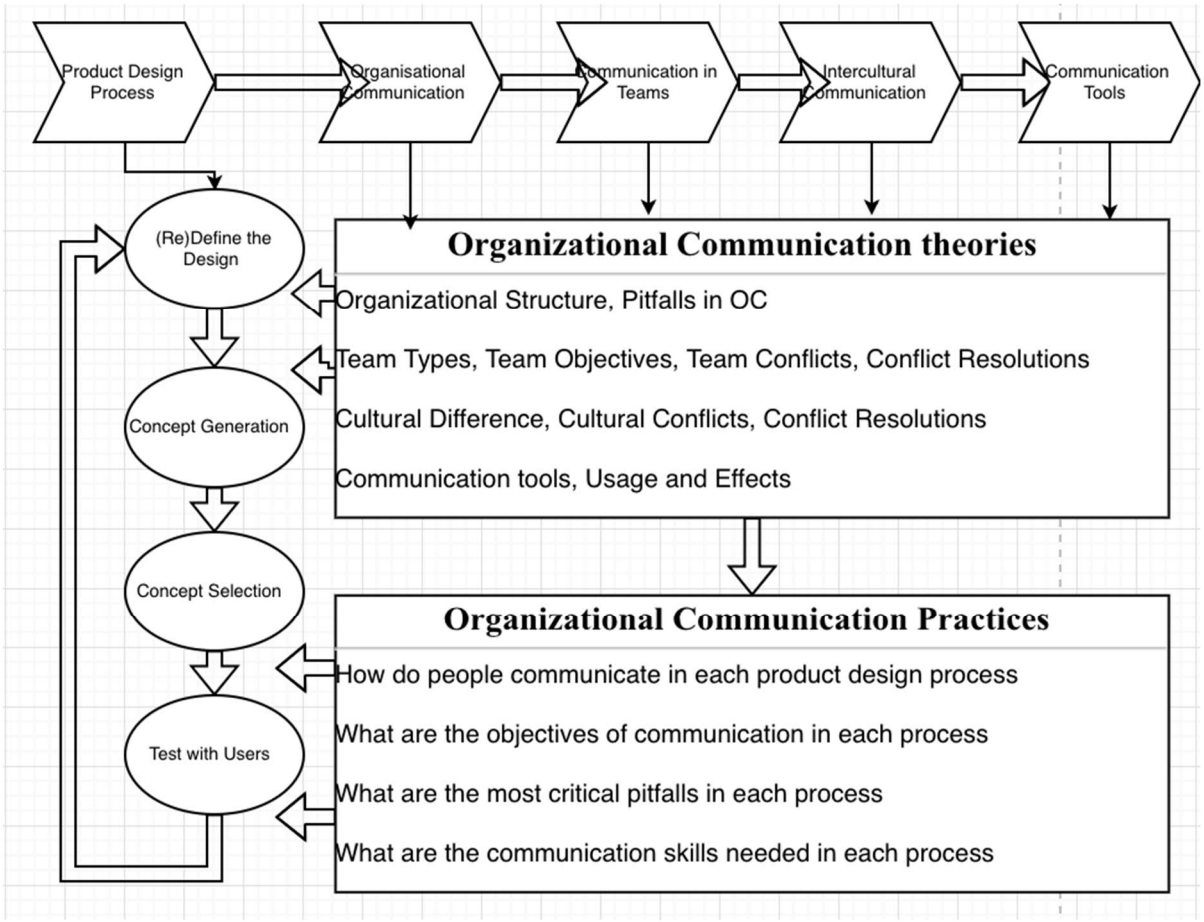


Figure 14. The theoretical framework of the thesis.

In the beginning of the literature review, it has focused on defining the most critical product design process. It turned out to be an iteration process including design problem, concept generation, concept selection, and test with users (Ulrich, 2003; Wiesche, 2018; Sutton & Hargadon, 1996…). In order to have a user-centered design, the product design team needs to keep this iteration process for many times. Also, in this section, we understand some background about typical product teams, and typical teamwork in some steps of the product design process.

In the next, to further understand the OC and OC in teams, a constant theoretical research has been conducted as such: organizational communication, Communication in Teams, Intercultural Communication, and Communication Tools. In the organizational communication, all the organization is divided by its different organizational structures (Koschmann, 2012; Eisenberg, Goodall & Trethewey, 2007…). In addition, there are three most common pitfalls in organizational communication: information overload, distortion, and ambiguity (Eisenberg, Goodall & Trethewey, 2007…).

In the section of communication in teams, it introduced different team types: Project team, work team, quality-improvement team, and virtual team. Due to the complex of the product team and its different objectives in each different product design process, product design team has the mixture of all the team types (Ulrich, 2003; Churchman & Rosen, 1990…). In addition to the team types, it describes different team objectives of different team types. In the next place, it reveals the team conflicts and conflict resolutions, which contributes to the team dynamic problems in the product design teams. There are typical four team conflict: Conflict over positions, strategies or opinions; Mistrust or uneven communication; Personality clashes; Power issues and personal agendas (Blanchard, Carew & Parisi-Carew, 1996). Meanwhile, a six procedure of conflict resolution has been introduced by the Guffey, Rhodes, and Rogin (2010): Listen, Understand the others' point of view, show a concern for the relationship, look for common ground, invent new problem-solving options, reach an agreement on what's fair.

Apart from the two main OC theories, there are two small studies in the intercultural communication and communication tools, in which product design team also involved during the teamwork in different product design process (Ulrich, 2003; Dym, Agogino, Eris, Frey, & Leifer, 2005…). In the Intercultural Communication, the cultural difference is defined by Hofstede's cultural dimensions (Hofstede, 1980). Cultural conflicts and conflict resolution are explained in the section of cross-culture communication in teamwork with the detailed description of the barriers and basic principles when facing those barriers (Guirdham, 2005; Roger & Kincaid, 198). In the communication tools, it is described as a relatively new field of part of OC study as the development of the information technology (Eyrich, Padman & Sweetser, 2008). In the global innovation program case, those different social media channels have mediated the communication despite the physical distance. (Eyrich, Padman & Sweetser, 2008). Also, some of the online tools can be used to facilitate the documentation and keep each teammate updated with the project work (Subrahmanyam & Greenfield, 2008).

In the end, after the OC theories, it comes to the OC practices which are aligned with the four sub-research questions. Both OC theories and OC practices are used to analyze the product teamwork in each different product design process. In the next, it insources the methods and data applied in this thesis, findings, discussions, and conclusions of the empirical research by applying the theoretical framework.

3. METHODS AND DATA

In this chapter, it introduces the research methods in this thesis in three parts. The first part is the Research Methods, which describes the two applied qualitative research methods in the whole organizational communication studies in the product design process. The second part is the Case Introduction, which presents the school product design project. The last part is the Collected Data, which explains the 10 interviews with the participants, the school teaching group, and the company representatives, as well as the analytical method of the collected data.

3.1 Research Methods

In this thesis, I take a qualitative approach to the empirical research part. To be more specific, it employs case study research and interview research. Qualitative researches attempt to go beyond descriptions to provide a researcher with an in-depth understanding of a phenomenon, unlike quantitative researches which are usually concerned with investigating and describing a phenomenon to a certain level (Anyan, 2013) in terms of numbers, quantities, figures, amounts, incidences, etc. Richards (2005) describes qualitative data as comprising complex records of observations, descriptions and, narratives which are context-bound and maybe irreducible to numbers.

In particular, in-depth interview method is applied in this thesis. In-depth interviews are optimal for collecting data on individuals' personal histories, perspectives, and experiences, particularly when sensitive topics are being explored (Denzin & Lincoln, 1994, p2). In addition, focus groups are effective in eliciting data on the cultural norms of a group and in generating broad overviews of issues of concern to the cultural groups or subgroups represented (Denzin & Lincoln, 1994, p3). It gives lots of insights from the in-depth interviews. An interview research has today become one of the most widespread knowledge-producing practices across the human and social sciences in general and also in critical psychology more specifically (Brinkmann, 2014). Interviews are useful because it gives voice to people's lives and their perceptions of experiences important to them (Belk, Fischer & Kozinets, 2013), and allow the researcher to understand the way they see the world (McCracken, 1988; Thompson et al, 1994). To answer the research questions in the thesis, it has conducted multiple interviews with the people who had hands-on experiences in a team-based product design process, which provides lots of insights for the research problem. As much as interviews are performative and constructivist (Alvesson, 2003), the researcher should enter the interview with a research question, albeit a loosely developed and mutable one. Kvale (1992, p174), described the purpose of interview as a method of data collection in social research as "…to gather descriptions of the life-world of the

interviewee with respect to interpretation of the meaning of the described phenomena". In corresponding to the definition of the interview as a method of collection in social research, this thesis is looking for the improvement of the organizational communication in a team-based product design process.

Furthermore, content analysis has been used to process the recorded tapes from the interviews. Content analysis is known as a class of research methods at the intersection of the qualitative and quantitative traditions, and it is a research technique used to make replicable and valid inferences by interpreting and coding textual material (Duriau, Reger & Pfarrer, 2007). By systematically evaluating text (e.g. documents, oral communication, and graphics), qualitative data can be converted into quantitative data.

In addition, the case study has been applied in the research. Due to the limited resources to research other production teams in other organizations or companies, the one-year product design project in the school has been used as a case study, which set a great example for the empirical research. On the other hand, it might bring faulty judgement because of looking into one product design team. However, people still choose to use case study method in the social psychology, management, and so on. One reason for the popularity of the case of case study research is its ability to present complex and hard to grasp the research issues in an accessible vivid, personal, down to earth format (Eriksson & Kovalainen, 2010). In addition, Humphrey & Scapens (1996) articulated case study research can also be used to gain a better an understanding of changing and mundane organization and management practices in their social contexts in a way that is not dominated by the managerial perspective. In the selected case of this thesis, case study research increases the credibility of the defined product design process.

To summarize, the research of this thesis utilizes the qualitative research method (in particular, the case study and the in-depth interviews), and content analysis is used to process the recorded interviews for further study. The case study research helps to understand the product design process better by investigating the objectives of the project, the detailed design of the project, and the final outcomes. Then, by conducting multiple interviews with the project participants according to the research questions, it gives an initial idea of the research problem and what are the problems. In order to understand the research problem better and find the correlations and answers for the research questions, content analysis is conducted in the discussion part.

3.2 **Case Introduction**

In the section, it aims to describe the case in detail. In general, the case is a school project but sponsored by different companies and collaborating with different universities from more than 20 countries around the world. The project teaches students to learn, apply, and experience the Stanford Design Innovation Process, which is known as the need-finding, benchmarking, iterative prototyping and user testing. Hence, User insights are uncovered, and creative solutions are developed, engaging a range of different design thinking tools and techniques (http://me310.aalto.fi/). The result is to have a proof of concept with prototype and detailed design solutions.

In Figure 13, ME310 Aalto (http://me310.aalto.fi/) is a master's level global innovation program. Also, many students think this is one of the most intensive but rewarding project courses taught at Aalto University Finland. Students of design, business and engineering come together as interdisciplinary teams to work on a year-long real-life challenge brought forward by an international company. In the project, students need to partner up with students from one of the top universities in the global ME310 network (called SUGAR in Figure 13) to form a global design team.

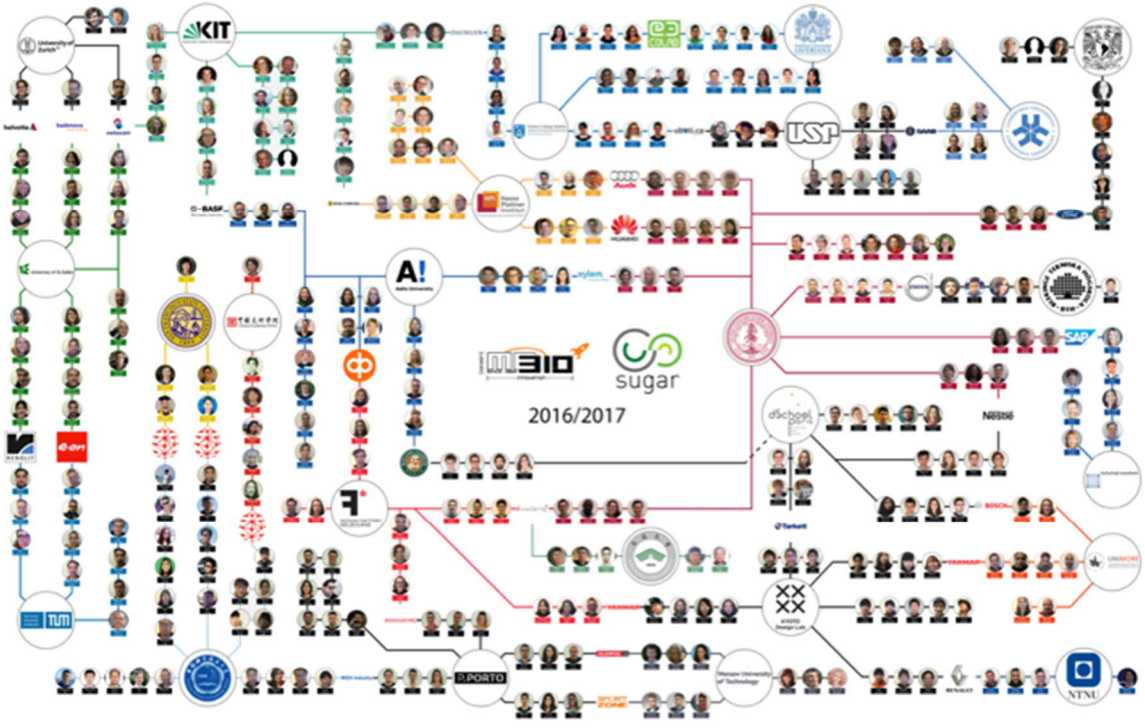


Figure 15. Global ME310 and SUGAR network (source: ME310 course material).

For instance, there is one Aalto Team: one member is from Design, another is from Business, the other two are from Mechanical Engineering, which has been given this broad topic "preventing the aging pipes by radically innovating the water transportation and treatment for the future 2030" by the sponsor company--Xylem, and work together with one of the global team from Stanford remotely by using the same methodology and process " benchmarking, need-finding, prototyping, redefining the concept". In Figure 14. The final proof-of-concept prototypes are displayed at the Stanford Design Fair each June at Stanford university in California.

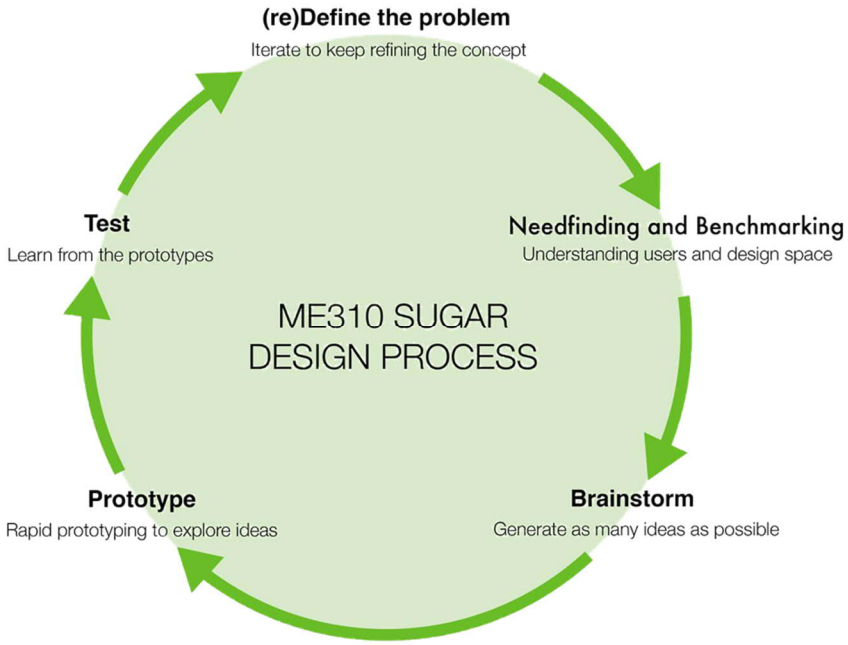


Figure 16 Stanford Design Thinking Methodology (source: ME310 course material).

In Figure 15, it shows that teams have to experience the three quarters: fall, winter, and spring, in this one-year-long project. No doubt they have been confronting team dynamics issues for thousands of times. And how to manage the team conflicts is crucial to the success of the team issues as many teaching assistants have mentioned. In aligning with the research questions: How to improve the organizational communication in a team-based product design process, especially with the remote global team. To be more specific, how do people communicate with each other inside a product design team? What are the different roles or objectives that each teammate is playing in the team via different product design process? What are the pitfalls of teamwork in the product design process? What are the key skills needed in team conflicts in the product design team? Therefore, it is important to take this product design project as a case study to go through the product design process and the organizational communication in the team-based product design process.

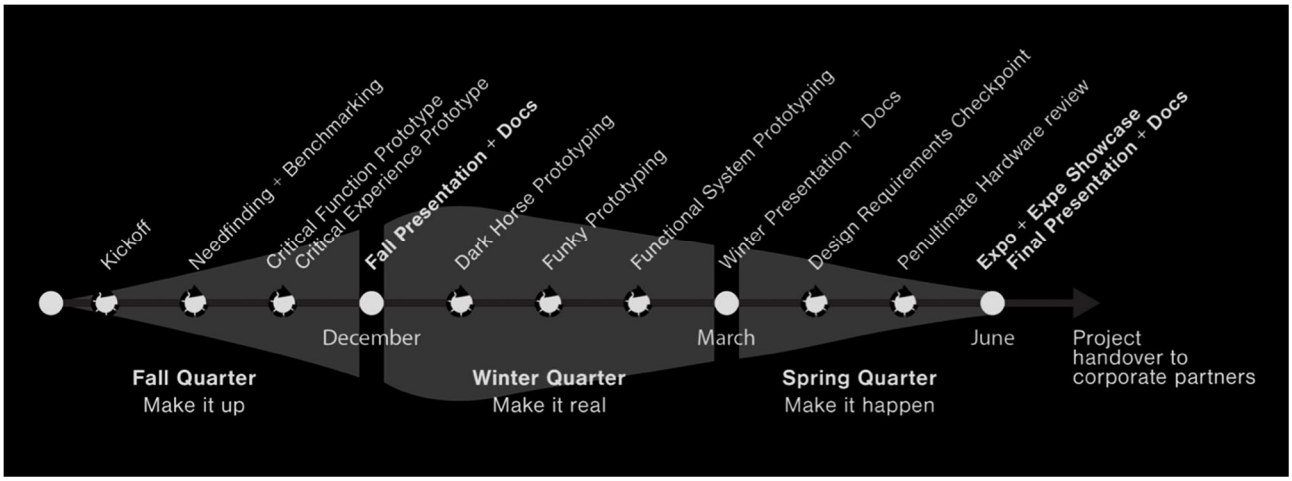


Figure 17. Aalto ME310 one-year initial schedule (source: ME310 course material).

Apart from the scheduled sections for one year, it has some routine activities such as the SGM, LGM, SUDs party, and I wish I like. SGM means the small group meetings, which happen every Thursday and takes about 30 minutes arranged by the teaching teams. During the meeting, the teams have the responsibility to show or tell what the team has done during the last week such as the outcomes, prototypes, and learnings. Meanwhile, the teaching teams are there for feedbacks and advice. Usually, the teams are asked to create an A4 handout, to sum up the work and progress for the teaching teams.

LGM stands for the large group meeting which takes place every Thursday and takes about 30 minutes as well. But, different from the SGM, LGM will collect feedbacks and advice from both the other teams and the teaching teams. Same as the SGM, the team need to create an A4 handout to show what the teams have done during the last period, as well as sum up the work and progress for the teaching team. The idea of having the LGM is to show other teams what you've been doing, get feedback and ideas from the other teams, and exchange learnings about good practices such as tools and methods that worked for the team.

Then, SUDS mean a Slightly Unorganized Design Session which takes place every Thursday. It is also known as a social even to facilitate peer learning student teams taking turns in organizing, which enhances the teamwork and friendship between the group members. In this informal environment, people are free to talk something unrelated to the project and get more familiar with each other instead of just being pure collogues in the project.

Lastly, I like I wish section is a section where the team members share their genuine thought about each other in order to resolve the team dynamic problems and enhance the teamwork in the future.

To be more specific, a host is needed to give instructions for the whole team, as well as some A4 paper sheets. In the paper sheets, each team members need to write their genuine thoughts on I like (good things that each teammate did, or you appreciated), and I wish (things that you dislike, or you want them to improve). “I like ***” always goes earlier than “I wish***”. After writing down all the feedbacks and people have to start with one teammate to speak in the front. Meanwhile, the person should be writing down the feedbacks from the other team members. In the end, he should come and make a statement to reflect on those feedback and improve those.

In the end, the outcome and objectives of this global innovation program are presented below.

1. reframe a problem considering the different stakeholders as well as the societal impact
2. understand how to design with incomplete information
3. be able to apply user centered design
4. understand the value of prototyping and be able to apply iterative prototyping
5. be able to communicate fluently orally, by writing as well as by visual and other means
6. be able to work in international interdisciplinary team.

To summarize, this one-year global innovation program aims to teach the students to use the design thinking process to develop a product (or service) in the early stage. The most critical part is how to improve the communication in team-based product design process due to the fact there are so many team dynamic problems holding up the product development process. As it has been mentioned by one previous Aalto ME310 member “the most difficult part is the team dynamic problem” when asked about the most difficult part in the whole project.

3.3 Collected Data

The research is conducted by the qualitative research methodology. One part is done by the case study mentioned in the last section. The other part is done in the interview methodology. The interview question is designed according to the research questions. In the appendix, we can find designed interview questions.

In total, we have interviewed 10 different people who have been in the ME310 program as a participant or teaching assistant or the representative from the sponsor company. 6 out of 10 are the participants from different teams both this year and last years. There are two people from the teaching assistant. And two interviewees’ are from the sponsor companies. In total, these interviews have

provided a good reference in the research questions. Due to the information privacy agreement, the interviewees name won't be shown in the thesis.

For the six different participants, the average interview time is about 10 minutes. The whole interviews are in a relatively relaxing environment, which helps to encourage the interviewees to talk freely about their experiences in the one-year project. Especially around the research topic, what are the pitfalls of teamwork in the product design process? And what the key skills needed in a team conflicts in the product design team? The participants may not often talk about this or even reflect on these matters in the project. See in Appendix 1, there are all the questions which consist of the warming-up questions, teamwork, communication tools, pitfalls, and skills. The key is to understand how those participants communicate with each other inside a product design team, what the pitfalls of teamwork in a product design process are, and what are the key skills needed in a team conflict of the product design team. In Table 9, it has introduced the background if the 6 interviewed participants.

Table 8. The background of the Interviewed participants.

Name Code	Nationality	Major	Team	Main role
Participant A	Finland	Computer Science	Nokia	Making prototype…
Participant B	China	Management International Business	Xylem	Business analysis, user testing…
Participant C	Finland	Industrial Design Business Management	Xylem	User interview, prototyping, user testing
Participant D	Mexican	Mechanical Engineer	Xylem	Making prototype, testing…
Participant E	Finland	Mechanical Engineer	Roche	Design, user interview, user testing
Participant F	India	Computer Science	Roche	Prototyping, testing…

For the two teaching assistants, they performed as managers and instructors to the whole product design team. Thus, it could be so meaningful to the communication studies in the team-based product design process. In Appendix 2, it presents the interview questions with the teachers. The core discussion with the teachers is: Firstly. What is the product design process; Secondly. How they guide the teams in the product design process; secondly, what are the most common pitfalls for a product

design team. On an average level, it takes about 10 minutes for each interview, but it gives an anther perspective to the product design teams and their work. In the end, it gives many insights for the needed skills of the product team.

For the two company representatives, they also performed as managers and instructors to the whole product design team. In Appendix 3, there are questions about the feedback for some projects from the company's perspective, which requires the interviewees to comment on the teams' work. Meanwhile, they were asked to explain what kind of pitfalls the team-based product design process will encounter from the company's perspective. Furthermore, in the interview with the company representatives, they give many insights for the needed skills of the product team.

To summarize, the collected data comes from the interviews with recordings. The task for analyzing those data is to listen to the recorded interviews and interpret into text for content analysis.

3.3 **Ethical Problems & Solutions**

In conducting the empirical research, there are many related ethical problems which may have a big influence on the findings of the research. Regarding the research objective and process, there are three main ethical problems: 1.The interviewees are not getting paid and have to answer the tough questions for about one hour; 2. Due to the legal problem, the company name and the detailed teamwork including the final proof of concept cannot be published in the thesis. 3. Without acknowledging the participants and teaching assistants, I have started the research already while we are still doing our project at that time, and it might influence the teamwork and bring more challenges to the team.

To alleviate and solve the first ethical problem, I have used my personal contacts to invite people for interviews and compensate them a cup of coffee and some dessert, people are more willing to tell a bit more about the questions and their teamwork. For the second ethical problem, it involves negotiations with the company representatives and professors. Although the professors are okay with putting her name and use some of the teach materials, some companies didn't see the value of doing so. So, I can't use the detailed project materials of each team. For the last ethical problem, my interviewees are most from the previous product design teams in the past years. Also, the teaching assistants shared some of their satisfaction survey with me for the research. Hence, the influence to the current project has been minimized.

4. FINDINGS

In the finding part, it summarized the result of the interviews after conducting the contextual analysis by listening to the recorded interviews and transcribing the audio into the text, after which we have to select the most relevant answers regarding the research questions and the research topics.

4.1 The Participants' Background & Motivation

Participants are from different countries (Finland, Germany, Australia, China, Japan, Korean, Vietnam, India, and so on) different majors (Business, Mechanical Engineer, Computer Science, and Design). As one of the interviewees has mentioned in the interview, the biggest challenge is how to communicate well with people from different countries and culture regarding the different phases of the project. Meanwhile, we have realized the students from the Asian countries are more collectivism comparing to the students from western countries. Furthermore, the students who studied business and design sometimes have a lot of ideas and concepts but do less, while the students from Science talked less but do more. In conclusion, the participants' backgrounds did influence their thinking on solving the design challenges.

Surprisingly, participants' motivation has a large influence on their performance in the project in the long round. Thought the professors and teaching assistants try to make the project more meaningful, the participants may think it's not interesting and just do it for the reason of being told to do so. However, the core of the product design is to teach the people to think out of the box, which requires the participants to think creatively and have passion for it. For most of the interviewees, when talking about the motivations, they want to learn and experience the design thinking in the product design project. However, they didn't deny the 30 credits received after the project is also a big goal or reason for them to take this project.

As the project workload is getting heavier and heavier, the participants who thought to do it more for credits gave in first. And sacking off from the project did affect the others in the team. There is one team which has faced this problem when one teammate is rarely doing the project work due to his job. In the end, they have to talk to the teachers and ask them to take some actions to the single participant who is always absent from the group meeting. On the other contrary, there are some participants from the other groups complaining about some people in the group working too much, which leaves pressure on the others. To summarize this finding, the workload should be balanced in

a project with a long schedule, because people may either get lazier in a relaxed environment or lose interest with too much pressure.

4.2 Teamwork in the Product Design Process

4.2.1 The Product Design Process

According to the interviews with the participants and the teaching assistants, they have different definitions about the product design process. As one of the interviewees has mentioned: “there are few phases. In the first phase, you need to talk to the users, and you learned a lot about the problems and the needs by **interviews**; in the second phase, you need to figure out how to solve those problems and fulfill those needs by **ideation**; then you implement by making **prototypes**; after that you **test** those prototypes with users.”

To summarize the answers to this question, there are four common mentioned vocabularies in the interviews with the participants: interviews, ideation, prototyping, and testing. After talking with the teaching assistants, they agreed with the participants’ definitions. In their words, they have mentioned it as: Define the problems, Need-finding and benchmarking, Brainstorm, Prototype, and Test. But most importantly, this is a continuous process which means the problems, or the needs can be redefined until the end-user’s pain points have been solved by exploring different solutions.

4.2.2 Teamwork in the Product Design Process

When interviewing the participants in the one-year product design process, there are both similar and different answers to the question. For the majority of teams from the interviewed participants (they are from different teams). But they don’t have a specific team leader, one participant has mentioned that they rotate the group leader. So, for instance, during this week, one person will be responsible for most of scheduling, and s/he needs to be more active in organizing and doing stuff for the team. As one of the participants has mentioned: “we tried to vote for a leader in the beginning, but when we do ideation and try to appreciate each idea, and it didn’t work. And when it came to prototyping part, each people were in charge of each task…” From the interviews, it is advised to have plane management in the product design team, which encourages the ideations and ownership of the project around the teammates.

When talking about setting goals and plans for the team, many participants pointed out it is highly recommended to always keep in mind who you are designing for, because the product design process requires the product design team to explore different areas around the given design brief from the company. In order to do so, many interviews, prototyping, and user testing have been conducted to see what is going on. During the small group meeting with the teaching assistant in each week on Thursday, the team has always been asked to answer the 3 questions: **why you did it? How you did it? What are the results and learnings?** This has a very important impact on teams planning and scheduling.

However, having the supervision in the product design process is not always a good thing. One interviewee has complained about the tight schedules. “we’ve been pushed to have some results during the Functional prototyping section, and we were sometimes just doing the things for the sake of doing it” she has complained: “each of team members were stressful and need to make quick decisions and taking care of our parts for delivering good contents during the supervision meeting, and it felt like we were not planning the schedules by ourselves.”

To summarize how the teamwork, we are supposed to have a complete understanding of this one-year project—ME310. Mentioned in the case study, and seeing in the roadmap of ME310 project, there are in total 3 quarters: Fall Quarter, Winter Quarter, and Spring Quarter. In each different quarter, there is a scheduled presentation day, which pushed the students to make some progress in each quarter. In addition to that, each quarter has also arranged different tasks. In the fall quarter, it includes the kick-off event, need-finding + benchmarking, critical function prototype, and critical experience prototype. In the winter quarter, it contains the dark horse prototyping, funky prototyping, and functional system prototyping. In the spring quarter, there are design requirements checkpoint and penultimate hardware review.

From the interview with the teaching assistants, they pointed out what they are doing is to teach the students at the beginning of the project and be a facilitator in the following time of the project. Hence, the students are mainly responsible for their project. Inside the team, each team member works together for the project. However, in every week small group meeting, the teaching assistants were always challenging us to make better products and improve the final design according to the requirements for this specific period.

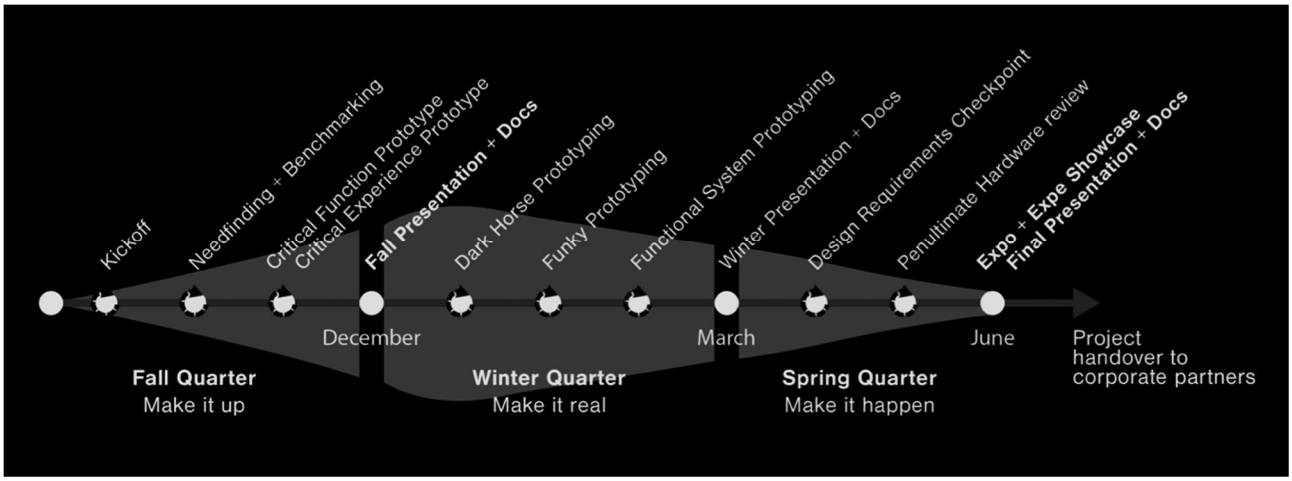


Figure 18. The roadmap of ME310 project.

4.3 Challenges of the Teamwork in the Product Design Process

In this section, the three major challenges of the teamwork in the product design process have been illustrated in the following context according to the interviews, which are language barriers, culture differences, and disagreement.

4.3.1 Language Barriers

In the interviews with most of the participants, it suggests that the language barrier is mainly focusing on the technical terms and vocabularies. “Because our project is related to water engineering, but we don’t have any people from chemistry in our team. It has resulted in the communication problem to the team members from business and design major…” one interviewee said. Apartment from that, English is not our native language and sometimes the teams cannot express the thought as fluently as we use our native tongue.

For example, in the paper bike project, the team used the quick mock-up/prototype to demonstrate the important components of the paper bike in Figure 17 before they start to build up the real bike. To solve the communication problem due to the language barrier, the teaching assistants have suggested the team to communicate by drawing sketches. Seeing in Figure 18, one team member in the water infrastructure has sketched his solution for a self-sufficient water system of a commercial building. In summary, the language barrier has existed from the beginning due to the chosen of an international group, but by practicing drawing sketches and making quick mock up, it greatly reduced the language barrier.

Figure 19. The mock-up in the paper bike project.

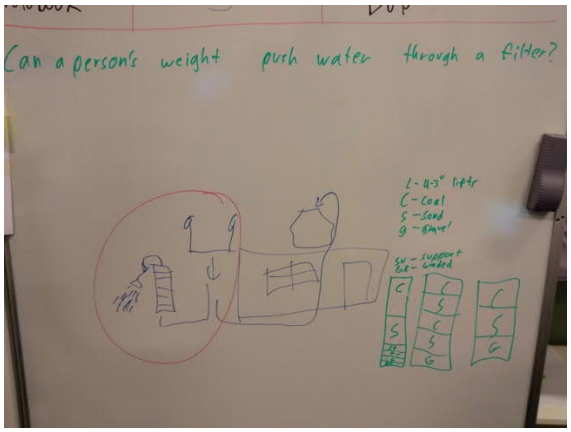


Figure 20. The sketch for the water infrastructure project.

4.3.2 Culture Differences

In one interview with the participants, there is one teammate originally from Columbia, who is a little bit talkative and strong opinion holder. On the other hand, there is a Chinese team member who is quite shy and rarely brought up with his own opinions. Meanwhile, there is another Finnish teammate who is also a strong opinion holder. In that case, people start to fight against each other badly in terms of different opinions. One interviewee said in the interview: "…I felt like my teammates don't want to communicate with me…" on the contrary, his teammate is complaining: "…I already gave in too much and kept my mouth shut, but she seemed not satisfied and pushed me to accept her idea…" The earlier interviewee is from Finland, and the later interviewee is from China. In Figure 19, it shows that people from Finland have higher scores in individualism, uncertainty avoidance, and indulgence than people from China according to Hofstede 6 dimensions about culture differences.

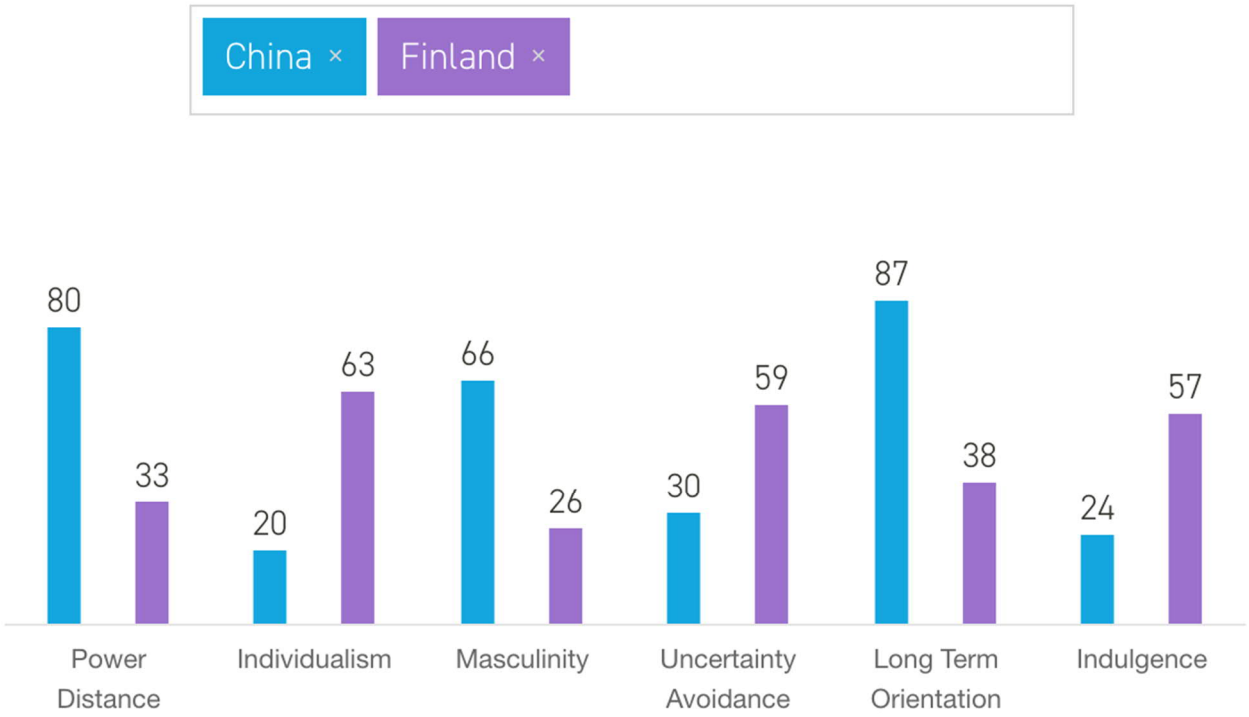


Figure 21. Country Comparison of Hofstede 6 dimensions from culture compass.

Hence, it explains that the former interviewee from Finland is more individualism and her expectations on the opened group discussion from others. However, her teammate from China was trying to look for agreement by avoiding different opinions and keeping each other's face. Also, with a higher long-term orientation, he might think about to have better corporations in the future by giving in this time. In addition, the two people's personality also has an impact on their communication style. The girl is always affirmative and determined on something, but the guy is a little bit shy and unconfident about himself. It results in the misunderstanding with each other too.

To summarize, the culture differences' impact on the communication of the international team cannot be neglected. However, the influence may also come from the person's personality, and the influence cannot be neglected in the teamwork. Meanwhile, due to the diversity of the participants in the team, the designed product can be more innovative.

4.3.3 Disagreement

From all the interviews, there is no such team which hasn't encountered any disagreement. Moreover, the disagreement may happen from the beginning of the project to the end of the project. The disagreement comes from the discussion or making decisions, and the people with different opinions need to reach an agreement. In the following interview context, it shows a type of the disagreement between the team and his point of view.

"…if you choose to do a design that someone didn't like and didn't do anything, they might lose their whole motivation because they feel like they are ignored. So, the only way to avoid this is to make them involved in the discussion and decisions…" (Male, 25years old, China, major in Management International Business, Team Nokia)

"… I would never work with the strong opinion holders, they are always stubborn on their own ideas, and it always ended up with an argument when getting into a discussion with them…" (Female, 30 years old, major in Industrial Design Business Management, Team Xylem)

The side effect of the disagreement between the team members is always slow down the process of the product design, especially when there are people holding different opinions regarding the topics. On the contrary, the good effect of disagreement is to diversify the design ideas, which has been valued for the product design process. The solution is to test and deeply analyze those different ideas under the purpose of finding out which is a more reasonable approach. However, if it doesn't go with this process of exploring and comparing the different ideas and opinions. It may end up with a team dynamic problem.

4.3.4 Team Dynamic Problems

The team dynamic problem is coming from the disagreement or culture differences in the beginning. One characteristic of the team dynamic problem is the inter-personal misunderstanding with each other. It may evolve into the personal argument with each other and even break up the team. In one interview, the interviewee has remembered one unpleasant team dynamic problem with one of his team members. "It was frustrating when he said he didn't care about other people's idea and just went for his own idea, then it ended up we all lost our interests and he was doing tones of work and started to complain that the others were not doing anything. It was really a bad cycle…" he mentioned in the interview.

Also, in another interview, the interviewee has said directly: “I just can’t work with her after we had a really bad argument, and she seemed not to like me and always wants to find trouble on me…” In this team, the team dynamic problem is severe after a big argument. As the teaching team has remembered, they can feel something wrong with this team. If it wasn’t the teaching team try to organize the “I wish, I like” section for them, the team would just end with break and failure in the project along with.

So, the team dynamic problem is severe to the team and it first affects the relations of the team members such as someone hate someone in the team, and then it started to frustrated people by reducing the motivation of the team members on the whole project. In the end, it may result in the failure of the whole project. However, it doesn’t mean it cannot be fixed and corrected during the project.

4.4 **Communication Tools**

In speaking of the communication tools used in the project, the interviewees have mentioned three main communication tools they have been often used: Google Doc for Documenting, What’s App for Instant Messaging, Social Media Apps in Communication,

4.4.1 Google Doc for Documenting

Because of the needs to documenting the work we have done, a platform for each team members editing is needed, which is also a good way to communicate the group work internally according to many interviewee’s suggestions. “…sometimes it’s better to write the ideas down because we already have a lot of discussions, and writing can help to organize our thoughts” one participant has pointed out in the interview. In Figure 20, it shows what the google docs convenient the people and contributes for the teamwork.

The biggest usage of this google docs is to store the documentation with video, pictures, text messages, and keep all the team members on the same page. As one of the participants has mentioned: “sometimes if one of the team members was absent for a period of time, s/he could still catch up by reading the documents in google shared folder…”. In that case, having a shared document not only

contributes for sharing and organizing the knowledge but also keeps all the team members on the same page even some team members were absent for a period due to some other work.

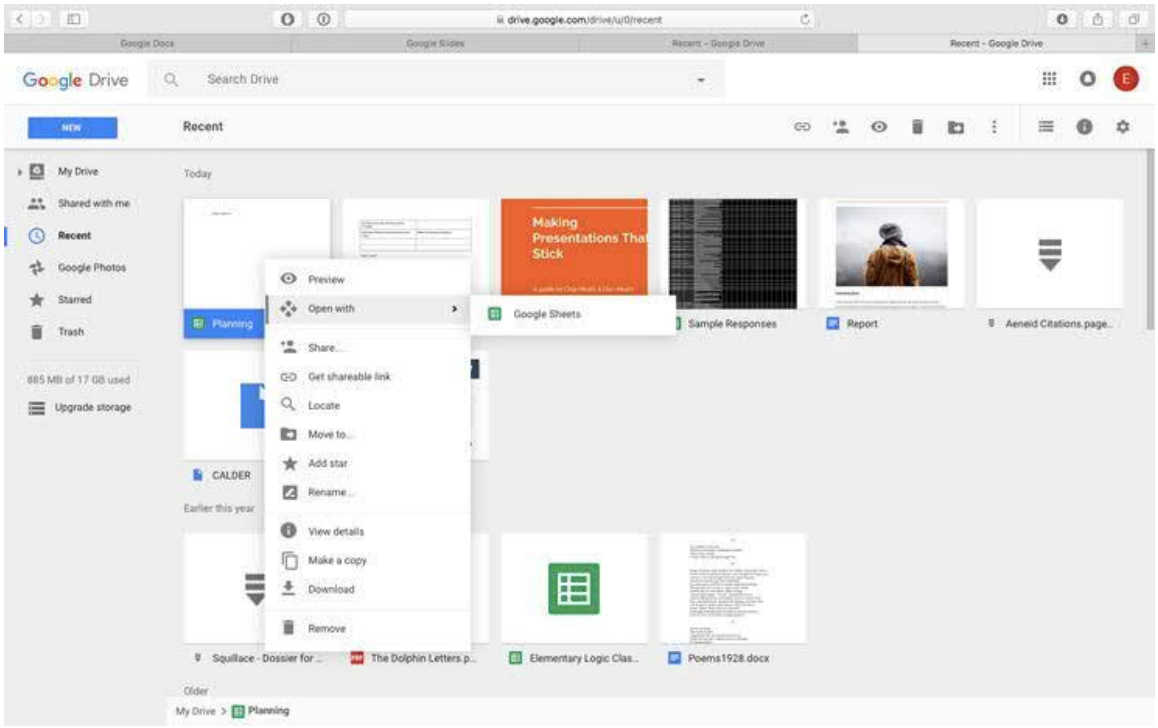


Figure 22. One example of the google docs' folder.

4.4.2 Social Media Apps in Communication

What's App for Instant Messaging

To have faster communication, all the teams were using instant messaging APPs. And what's APP is the most commonly used one. Seeing in Figure 21, it is the screenshot of the interface of what's app.

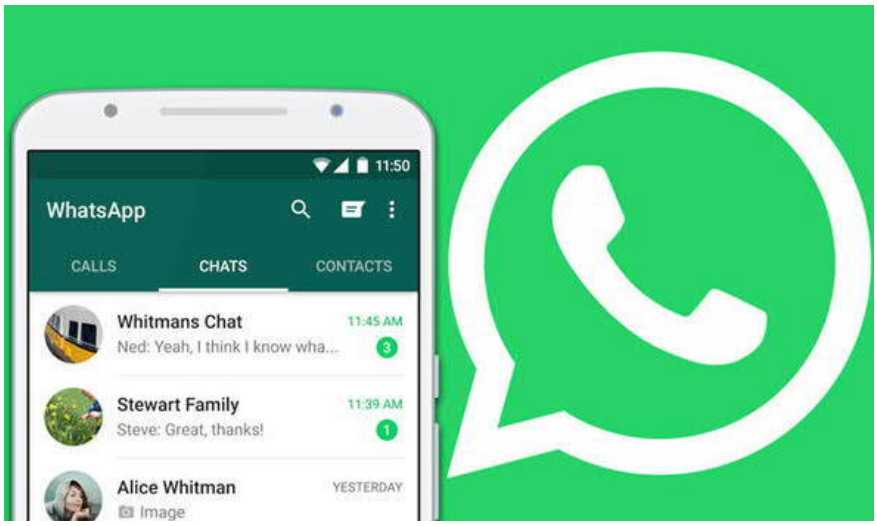


Figure 23. One example of what's app interface

Google hangout or skype for online meeting

Due to the time differences with the remote international team, online meeting communication is necessary for the teams to keep in touch with each other. Skype, seen in Figure 22, is the most commonly used communication tools used in this case. It has been mentioned by many interviewees that the efficiency of the conference is really important, but also it is very difficult to have a highly efficient online conference call. Before the calling, it is advised to have a draft on the topics of the meeting and check the equipment's durability. During the meeting, it is advised to keep a turn in the discussion because it would be hard to listen to people if all the people are speaking at the same time. Meanwhile, people should give the other people the opportunities to speak. One participant has complained: "…we have this guy from our remote team, he just couldn't stop talking…". After the conferences, same as the other group meetings, it should head towards to group decisions and specific result.

Figure 24. One example of the skype conference call.

4.4.3 Doodle for deciding the meeting time

In the group work, what troubles us, in the beginning, is always about settling down a group meeting time which suit everybody. As one participant has mentioned, before using doodle, we spend almost one hour to discuss the meeting time. After using the doodle, every team member only needs to spend a few minutes typing in the available time. Then the teams can see which time suits all the people as it shows in Figure 23.

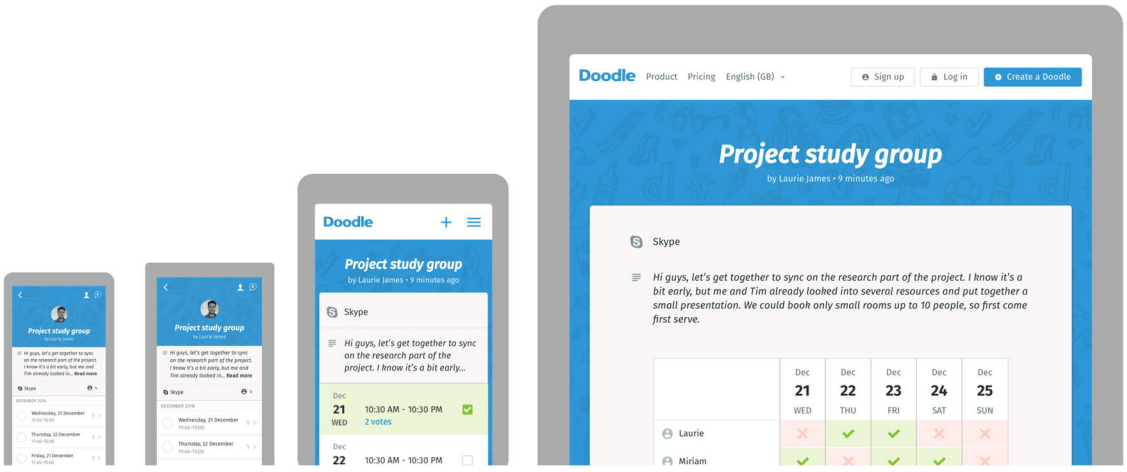


Figure 25. One example of the Doodle interface and usage.

4.5 Skills to solve the team dynamic problem

The next question is about how to solve the team dynamic problems according to the interview, and what we can learn from the case study and interviews. After conducting the interviews with both the participants and the teaching assistants, it reveals three efficient and reliable ways of communication methods for the team dynamic problem in the product design process.

4.5.1 Drawing & Writing Things Down

When we tried to describe something abstract, it is advised to draw a picture in similar to the reasons of language barriers. Also, when we need to organize our mixed thoughts, it is advised to write it down or draw a mind map. In the formal situation, we could understand better from the drawing about the abstract things because of the concrete picture. In the latter situation, the mind map or the writing down points can facilitate the narrative in the discussion.

From the interviews, many disagreements and team dynamic problem begin with the misunderstandings. "…we sometimes don't know what he/she is trying to talk about as a non-design student when hearing the teammates from the design background explaining us why this setup is better than the others." One interviewee said.

In this case, students from different backgrounds may always have different thought and opinions. It is a good thing in terms of diversity if all the team members are on the same page and understand the different ideas and opinions. Hence, in order to keep everybody on the same page, drawing and writing things down is useful way to convey the message. Moreover, the communication may take a lot of time by purely talking while communicate with the picture and mind map increase the efficiency largely.

4.5.2 Decision Matrices

First of all, when interviewing the teaching assistants about skills to solve the team dynamic problem, they have introduced the basic communication methods which are also called concept selection in the product design process. In the product design, the team is required to be innovative and creative in terms of concept generation after given a design brief. After that, the generated ideas need to be selected due to the limited resources of the product design team. To do that, **Decision Matrices** is introduced into the teamwork of the product design illustrated in the literature review.

"*There are two stages for the **Decision Matrices**: **Concept Screening** and **Concept Scoring**. Each of them is supported by a decision matrix which is used by the team to rate, rank, and select the best concepts…" (Male, 27 years old, Finland, major in Computer Science, Team Nokia)*

"We always advise the team to make decisions by themselves, because only that all the team members felt more involved in the project, which will also enhance their ownership and their contributions…" One teaching assistant said. (Male, 28 years old, Portugal, major in Industrial Design, Teaching assistant)

In Figure 24, it is an example of how people start to select different design approaches. There are different criteria for those approaches, and people can vote for minus, 0, and plus for the different solutions. Afterward, the sum of each option needs to be accumulated. The ones with the higher score are the ones need to be further developed and explored.

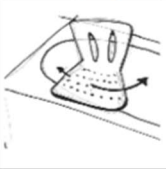
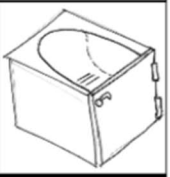
	DATUM	OPTION 1	OPTION2	OPTION 3	OPTION 4
	Swivel Chair w/ Hinge Leg	Hydraulic Swivel Chair	Pivoting Tub	Shower Grips	Tub Door
Sketches					
CRITERIA					
Aesthetics	DATUM	0	-	+	+
Cost (low preferred)		-	-	+	0
Ease of installation		0	-	+	-
Safety in use		0	-	-	+
Ease of getting in and out of tub		+	0	-	0
Intuitive use		0	-	+	0
Ease of maintenance		-	-	+	0
Bathing comfort (ability to relax and lay in bath)		0	+	+	0
Noise		-	-	0	0
Space required		0	-	+	+
Universal		0	-	+	0
Total +	0	1	1	8	3
Total 0	0	7	1	1	7
Total -	0	3	9	2	1
TOTAL	0	-2	-8	6	2

Figure 26. The example of the Pugh Concept selection method ((Karl, 2003, P124).

4.5.3 "I wish, I like" Section

“I wish, I like” section has been mentioned so many times in the interviews with the participants. It is introduced by the teaching assistant again. “I wish, I like” is a special group meeting organized by one of the teaching assistants together with all the team members. Each team member is given some papers with two writing categories: one for “I like***”, one for “I wish***”. For instance, there are 4 members in a team, so there should be 5 papers with each member name and the other one for the whole team. On each paper, there are two parts: I wish, and I like.

“I wish” stands for the things that you dislike about your teammates or the whole team. “I like” stands for the things that you appreciate about your teammates. After the teams have finished written down for the others, and the team. The teaching assistant will start to ask to start the teammate to go to the front and talk about what he wrote about the teammate with a start “I wish…” or “I like…”. Meanwhile, the teammate who has been given suggestions should listen carefully and write down those suggestions about himself on the paper. During the section, the teammates are not required to defense himself or herself. After finishing with all the speeches, the person who has been given suggestion should come to the front and make a commitment as well. In the end, it’s time for giving the suggestions about the whole team by starting with the same phrases: “I wish…” and “I like…”

“It indeed helps us to be honest about what we felt about the others and gives an opportunity to speak it out. Meanwhile, after listening to what the others are thinking about you, you know how to improve yourself…” (Female, 22years old, Finland, major in Mechanical Engineer, Team Roche)

“It is not about accusing each other, it is truly about improving each other and help others to improve…” (Male, 27years old, Vietnam, major in Industrial Design Business Management, Team Nokia)

“I felt motivated again after the “I wish, I like” section every time because all the teammates are sharing what they are truly thinking about. Besides, when talking about the “I like…” we felt what we have done for the team has been appreciated by the others…” (Male, 25years old, China, major in Management International Business, Team Xylem)

“We did understand each other more than before and started to respect each other’s opinions after the section, though we had lots of arguments before and even stopped talking with each other…” (Male, 27years old, Mexican, major in Mechanical Engineer, Team Xylem)

In terms of solving the team dynamics, “I like, I wish” section did help the teams according to the plenty of interviews with the participants of the project. In fact, it doesn’t solve the disagreements or conflicts directly. Instead, it emphasizes the empathy between people. Furthermore, it has helped to create a frank communication environment in the team with no hidden thoughts. All in all, “I like, I wish” section has encouraged the sharing and caring in the team, though the team may have lots of the disagreements and even conflicts with each other. Most importantly, the team starts to look at the future after this section by abandoning the previous unhappy teamwork experiences.

4.5.4 Team Building Activity

When getting into a team dynamic problem in the product design process, it does affect the relations of the team members. To bridge the gap and the unpleasant experiences between the team members, the team building activity is a rather good replacement for that. In the project, the teaching assistant has scheduled a weekly dinner party called SUDS, which refers to Small Unorganized Dinner with Sponsors. In the interviews with the team, it gives more insights on how exactly the SUDS party has contributed to their teamwork.

“It is each team’s turn to make food for the other people, in preparing the food for the party, each team member needs to communicate and cooperate together, and it is the time for all the teammates to accomplish one thing together, and it feels the sense of achievement after making a good food dinner for the others…” (Male, 25years old, China, major in Management International Business, Team Xylem)

“In the SUDS party, it is the only few times that we don’t have to talk about the project, and it increases our relations in getting to know each other’s characteristic and personality more. And it indeed helps in the teamwork for the product design project…” (Male, 27years old, Mexican, major in Mechanical Engineer, Team Xylem)

“In the SUDS, we also get to talk with the alumina or other teams, it helps to improve our design and find other approaches if we are facing some troubles right now…” (Female, 22 years old, Finland, major in Mechanical Engineer, Team Roche)

The SUDS party is only one example of the team building activity. However, it provides us a new approach to solve the team dynamic problem, which is focusing on increasing the personal relations

between the team in casual time. Meanwhile, people can share information and ideas about the project or maybe even find innovative ideas according to the casual discussion in the community. The creative idea always comes without purposes.

5. DISCUSSION

In this section, it reviews the main findings in Chapter 4, and the literatures in Chapter 2. Although there are many academic studies in the fried of product design and organizational communication solely, only a few studies in combining both product design and organizational communication. And the four research questions are listed here according to the research topic.

1. How do people communicate with each other inside a product design team?
2. What are the different roles or objectives that each teammate is playing in the team via different product design process?
3. What are the pitfalls of teamwork in the product design process?
4. What are the key skills needed in team conflicts in the product design team?

In the literature review, it explored the previous academic studies on the product design process, concepts in organizational communication, communication in teams, intercultural communication, and communication tools. However, it is not sufficient to answer the listed research questions due to the lack of empirical research, which gives a complete answer or analysis on the research questions and links the theoretical research. Thus, combining the theoretical and empirical research gives insights into the research questions. In this chapter, the main findings in relation to the literature review are discussed to increase the credibility of the whole research.

Q1.

To answer the first research question, it is introduced in the findings that what the interviewees think about the product design process. Many teams have participants from very different cultures and backgrounds. In the 2.1.3 Product Design Team, it has been mentioned by Ulrich (2003, p3) that product development requires contributions from nearly all the functions of a firm or an organization; but three main functions are marketing, design, and manufacturing. From the interviews, it has been noticed that about 80 percent teams are made up with the students majoring in different subjects, especially the business students, who understand more about the market and the customers' needs instead of chasing only for the functionality and advance of the design. It is mentioned by Ulrich (2003, p78) that the degree of customer satisfaction & needs depends to a large measure on the quality of the underlying concept. The approach of communication as a balance of creativity and constraint is the moment-to-moment working out of the tensions between the need to maintain order (constraint) and the need to promote changes (creativity) (Eisenberg, Goodall & Trethewey, 2007, p28).

However, the very different backgrounds of the teammates increase the disagreements between the teams and the disagreements may develop into team conflicts, which may cause the failure of the project. In the 2.4 Intercultural Communication, it has analyzed the difficulty of cross-cultural communication problems. In a product design team, the teams are from different backgrounds which causes the challenge of miscommunications between each other.

Q2.

To answer the second research question, in the interviews, many interviewees have mentioned that there are not specific team leaders in the team, which can be treated as plain structure. In both 2.2 Concepts in Organizational Communication and 2.3 Communication in Teams have mentioned that It is important that the organization be aware of the various patterns of group communication and how these can function to advance the aim of effective communication (Perkins, 2008, p104). After combining the studies in the interview, the product design team in the case studies is defined as a social pattern, which increases the generated concepts in the concept generation process but slowed the concept selection process.

When talking about the objectives of the team, it has been mentioned in the 2.2 Concepts in Organizational Communication that the approach of communication as a balance of creativity and constraint is the moment-to-moment working out of the tensions between the need to maintain order (constraint) and the need to promote changes (creativity) (Eisenberg, Goodall & Trethewey, 2007, p28). In the interviews with the product design team, they have mentioned the struggling between getting more creative ideas and getting things done. In other words, the objectives or schedules have been pushed the team so hard, which affects the motivation and the design result.

Q3.

In the third question, it is revealed in the finding part that three main challenges in the teamwork: Language Barriers, Culture differences, and disagreements. All in all, all the challenges may have the potential to develop into a team dynamic problem. In the 2.4 Intercultural Communication studies, the differences. Given by the definition of cross-culture communication, culture elements during the cross-culture communication are made up of two major parts, which are Verbal elements and Nonverbal elements (Ferraro, 2006). The verbal difficulty is the language barriers mentioned in the interviews while the nonverbal difficulty is the culture differences mentioned in the findings.

For the disagreement and the team dynamic problems in the findings, it has been also mentioned in 2.3.4 Team Conflict, there are four types of conflicts: conflict over positions, strategies or opinions; mistrust or uneven communication; Personality clashes; power issues and personal agendas. (Blanchard, Carew & Parisi-Carew, 1996). Many team dynamic problems between the teammates have been presented in the findings. When accusing the reasons for getting into the team dynamic problems, not making room for the others is the number one reason. Sometimes, it is also the personality clashes, which is so hard to get rid of this stereotype from people's mind. It is the same as changing people's personality. Furthermore, in 2.2.3 Pitfalls in organizational communication, Information Overload, Distortion, and Ambiguity are the three main pitfalls in organizational communication.

Q4

In the last research questions, the findings have given good insights for the key needed skills in the team dynamic problem. Firstly, drawing or writing things down can help to convey the message accurately comparing speaking. The definition of the organizational communication is the process of **"sending"** and **"receiving"** messages between two or more people through verbal or nonverbal means (Kreps, 1986, p10).

Secondly, using the decisions matrices can faster the concept selection process. One big advantage of using this method is to prevent the personal clash into the decision-making process by giving each people voting rights and avoiding the strong opinions holders taking over the decisions. Small-Group Communication requires a broadening of our communication abilities to include three or more perspectives, all operating from different perspectives, which are often assumed to be compatible (Perkins, 2008). Thirdly, "I wish, I like" section increases the empathy and honesty communication climate. In a team conflict, it has been suggested for all the members to reflect on themselves what they are trying to communicate and how they are communicating (Perkins, 2008, p56). "I wish, I like" section gives a chance for the team to reflect on themselves, which can help to resolute the previous team dynamic problems.

Last but not least, from the interviews, the team building activity provides an opportunity for meeting each other in a casual time and can develop the friendship instead of only teammates for the product design team. Besides, it has helped to generate more ideas when meeting the difficulties in the design project. In organizational communication, the different patterns of the team have different effects on the team (Eisenberg, Goodall & Trethewey, 2007, p243). In the last, online communication tools

improve the communication process largely in the product design process. Google doc for documenting, what's up for instant messaging with urgent purposes, doodle for deciding the meeting time. In 2.5.2 Online Communication Tool, it mentioned the trend of using online communication tools in organizational communications as the development of internet technology during the past few years.

To sum up, the theoretical part has explored the product design process, organizational communication, communication in teams, intercultural communication, and communication tools. Meanwhile, the empirical part has researched several product design teams in the case project. In chapter 4, the main findings from empirical research have been presented. Firstly, it has introduced the background and motivations of the product design team, and it has been found that a product design team are always from the different background to increase the innovative concepts in terms of the design brief, but meanwhile, it brings more team conflicts. Then, it illustrates what is the structure of the product design team in the different product design process. Due to the different expertise in the team, there is no sort of leaders according to the interviews. Instead, it has been encouraged to have plain management to increase the transparency in the teams. In the next, it has introduced the challenges of the teamwork in the product design process such as the language barriers, culture differences, disagreement, and team dynamic problems. In the last, it has introduced the key skills to solve the team dynamic problems and different communication tools applied in the product design process.

All in all, the answers to the research questions have been discussed based on the findings and the related literature review. In a product design process, the product design team are required to collect the user needs and adjust the design all the time for the team in order to have User-Centered-Design. In the organizational communication, it is about to make team decisions all the time, during which there are lots of disagreements and team conflicts due to the fact that people always think differently and also most of product design teams are having very different backgrounds. Hence, the team dynamic problems such as language barriers, culture differences, disagreement, and team conflicts, are unavoidable in the product design process. To improve that, it has been advised to first understand the team conflicts, and then the team need to use the communication tools such as google doc, what'up, doodle to improve the efficiency of the communication in the teamwork. Lastly, the product team is suggested to apply the skills to reduce and solve the team dynamic problem: drawing and writing instead of speaking to convey the messages, use decision metrics to make decisions, use "I wish, I like" section, have some team building activity, and use online communication tools.

6. CONCLUSION

The final chapter of this study concludes the research aims, methods, and main findings, and sums up the study. Section 6.1 discusses the practical implications of this study. Section 6.2 presents the limitations of the study. Finally, section 6.3 gives suggestions for possible future researches.

6.1 **Practical Implications**

The finding of this study is to improve the organizational communication in team-based product design process, as many product design teams in the newly created team with expertise from different departments of the firm misunderstand with each other, especially when there are short money and time resources provided, as well as when the team members are from different cultures under the trend of globalization, etc. (Davila, 2000; Brown & Eisenhardt, 1995…). To further present the practical implications of the study, the practical implications have been divided into four parts according to different important stakeholders in the case study: product design team, company, and manager of the project, school teaching assistants, and users.

Firstly, if the product design teams have equipped themselves with the organizational communication knowledge before the product design process, it will improve the product design process largely. In the group work, the product design team will start to respect each other's 'opinion based on plain management in the team and also the basis of people is from different expertise and background. When there are some team dynamic problems, people can use the key skills mentioned in the findings: drawing and writing instead of speaking to convey the messages, use decision metrics to make decisions, use "I wish, I like" section, have some team building activity, and use online communication tools. Especially, when using the "I wish, I like" section, it helps to create a sympathetic and trustworthy communication climate, where each team can share their own opinions freely and enlighten the future success of the project and the designed product for each of us.

Secondly, the company and manager of the product design team can apply the organizational communication knowledge into their selection and KPI of the product design team for a specific project. In the selection of the team, it is recommended to select the product team from people with different backgrounds and expertise due to the needs of having more innovative product. When setting the KPI for the product design team, the better organizational communication could also be one of the criteria, because a sympathetic and trustworthy communication climate contributes to the

final success of the design in an indirect way. In the company's big picture of the management structure, the practices of the product design team can give some references to that. On the one hand, the company would like to push the employee to work hard and get a good result with pressure, on the other hand, the company knows giving more flexibility to the team helps to generate more creative ideas.

Thirdly, by understanding more about the organizational communication in the product design process, the school teaching assistants know better to instruct the participants in the product design instead of focusing purely on the final result of the product design result. The process can be also valuable for the whole product design process. More importantly, when there are some team dynamic problems happening in the product design team, the teaching assistants can give the most supportive help to the team and help them to get over of it. During the teaching section of the project, the teaching group can give lessons about the different communication tools, drawing & writing things down instead of talking, decision matrices, use "I wish, I like" section and team-building activity.

Finally, when it comes to the users & customers of the product design target, the study of the organizational communication in a product design process can reduce the traditional and boring product. Due to the plain management, each teammate can share their design ideas. Besides, under a sympathetic and trustworthy communication climate, it is easier for the team to design more humanized products. Hence, the users can use the more humanized design if all the product design teams have devoted more sympathetic emotion to the game.

6.2 **Limitation of the Study**

This section presents the limitations of the study, and it supplements the findings and implications of the study. However, the limitations do not diminish the credibility and reliability of the study.

The topic of the study was challenging because of the difficulties to find direct related to previous theories and researches. There are plenty of studies in the field of organizational communication and the product design process. However, when studying organizational communication in the team-based product design, no direct previous studies can be referred to the thesis. Moreover, the product design process is a developing subject with lots of real case studies, which causes the difficulty in defining the standard product design process in the early stage. In addition, the theory of organizational communication is too abstract to apply to empirical research.

The selection of one single case study naturally brings some limitations for the whole research. Since the product design team case is based on a school project, it may not represent the situations in the product design teams inside the companies. And the time schedules might be much tighter, and the demand from the company might be much higher than the school project… Furthermore, there is no teaching assistants giving any instructions or supports or arranging any design sections and team building activities for the product design team. Therefore, the selected student product design project may not be so representative of the actual product design process inside the companies.

In the interview section, there are also three major limitations: 1. Participants may avoid to say bad words about their teammates in the interviews; 2. Participants may not realize their own problems when there are some miscommunications; 3. Company representatives and teaching assistant may have strong influences on the guidance of the product design process. On the one hand, people tend to hide some truth in the interviews when they are uncertain whether the interviews will be published or not. On the other hand, people may easily accuse the problem to others, which is the concern of the second ethical problem of the research. In appendix 1, there is one question "Do u come across any team dynamic problems in the teamwork? What are those?" many interviewees have mentioned the miscommunication, and when asked what or who causes the miscommunication, they tend to start with the others problem first. Hence, to prevent that, we always add another questions afterwards "As a member of the team, how did u help with the miscommunication problem." this question has reminded them that as a member of the team, they also have responsibility to keep good communication inside the team instead of only accusing the problems to the others.

Due to the fact that I have also participated in the product design project, there may have some subjective opinions bringing into the interviews with interviewing the previous participants. Thus, some of the findings from the interviews might not be influenced by me. However, it is also the typical limitation of the qualitative research method from the beginning. On the other hand, it is because I have participated in the project that the product design process and the teamwork can be presented in detail.

6.3 **Suggestions for Future Research**

As I have discussed in the theoretical part, there are different ways to conduct the researches on the subject of organizational communication and product design process. Also, because it is a relatively new research topic of putting the communication and product design process study together, there are various ways to continue the research at hand. In this section, it suggests three possible directions for the possible further researches.

First of all, as the current study is based on the school organized and company-sponsored product design team and process, there might be quite different findings from other types of product design team and process. Moreover, it would be interesting to see what the most common organizational communication problems are in those product design team and process. Thus, it could be more persuasive and increase the practical implications of the organization communication in a team-based product design process to the companies and product development researchers.

Secondly, the organizational communication studies are always conducted with the qualitative research such as case study and interviews, which could be very subjective depending on the researchers and not enough to compare the differences of each answer. For instance, the team dynamic problem can be measured into different scales from 1 to 10 according to the team's descriptions, and then compare the result of applying different communication tools or skills to solve the team dynamic problems. It would be interesting to see how to apply different communication tools and skills according to the quantified organizational communication problems in the product design process.

Lastly, as the current study is focusing on the organizational communications after defining the standard product design team and process, the future study could focus more on how the organizational communications have influenced the product design team and its process.

In conclusion, this thesis has just opened the door for the study on organizational communication in a team-based product design process, and it has found out that team dynamic problem is inevitable in the product design process such as disagreements, team conflicts and so on, but creating a sympathetic and trustworthy communications climate is the solutions for that as well as some useful communication tool in the product design process.

REFERENCES

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-centered design. *Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications*, *37*(4), 445-456.

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-centered design. Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications, 37(4), 445-456.

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-centered design. Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications, 37(4), 445-456.

Abras, c., maloney-krichmar, d., & preece, j. (2004). User-centered design. Bainbridge, w. Encyclopedia of human-computer interaction. Thousand oaks: sage publications, 37(4), 445-456.

Akao, Y., King, B. and Mazur, G.H., 1990. *Quality function deployment: integrating customer requirements into product design* (Vol. 21). Cambridge, MA: Productivity press.

Alvesson, M. (2003). Methodology for close up studies–struggling with closeness and closure. Higher education, 46(2), 167-193.

Anyan, F. (2013). The Influence of Power Shifts in Data Collection and Analysis Stages: A Focus on Qualitative Research Interview. Qualitative Report, 18, 36.

Axley, S. (1984). Managerial and organizational communication in terms of the conduit metaphor. Academy of Management Review, 9, 428-437.

Baltatzis, G., Ormrod, D.G. and Grainger, N., 2008. Social networking tools for internal communication in large organizations: Benefits and barriers. *ACIS 2008 Proceedings*, p.86.

Begley, C. M. (2009). Developing inter-professional learning: tactics, teamwork and talk. Nurse education today, 29(3), 276-283.

Belk, R., Fischer, E., & Robert, V. K. (2013). Qualitative Marketing and Consumer Research.
Berlo, D. (1960). The process of communication. New York: Holt.

Blanchard, K., Carew, D., & Parisi-Carew, E. (1996). How to get your group to perform like a team. Training & Development, 50(9), 34-38.

Breen, V. (2005). Consensus Problem-Solving Increases Perceived Communication Openness in Organizations. Employee Responsibilities and Rights Journal, 17(4), pp. 215-229.

Brinkmann, S. (2014). Interview. In *Encyclopedia of critical psychology* (pp. 1008-1010). Springer New York.

Brown, S.L. and Eisenhardt, K.M., 1995. Product development: Past research, present findings, and future directions. Academy of management review, 20(2), pp.343-378.

Brown, S.L. and Eisenhardt, K.M., 1995. Product development: Past research, present findings, and future directions. *Academy of management review*, *20*(2), pp.343-378.

Brown, T., 2009. Change by design: How design thinking creates new alternatives for business and society. Collins Business.
Capozzoli, T. K. (1995). Managers and leaders: a matter of cognitive difference. Journal of Leadership Studies, 2(3), 20-29.

Cattarin, J. A., & Thompson, J. K. (1994). A three-year longitudinal study of body image, eating disturbance, and general psychological functioning in adolescent females. Eating Disorders, 2(2), 114-125.

Chandra, Das, Ramesh. (2016). Handbook of Research on Global Indicators of Economic and Political Convergence. IGI Global. ISBN 9781522502166.

Cheney, G., Christensen, L. T., Zorn Jr, T. E., & Ganesh, S. (2010). Organizational communication in an age of globalization: Issues, reflections, practices. Waveland Press.

Condon, John. & Fathi Yousef. (1975). Introduction to intercultural communication. Indianapolis: Bobbs-Merrill.

Davila, T., (2000). An empirical study on the drivers of management control systems' design in new product development. Accounting, organizations and society, 25(4-5), pp.383-409.

Davila, T., (2000). An empirical study on the drivers of management control systems' design in new product development. *Accounting, organizations and society*, *25*(4-5), pp.383-409.

Denzin, N. K., & Lincoln, Y. S. (1994). Handbook of qualitative research. Sage publications, inc.

Dyer Jr, W. G., & Wilkins, A. L. (1991). Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of management review*, *16*(3), 613-619.

Dym, C. L., Agogino, A. M., Eris, O., Frey, D. D., & Leifer, L. J. (2005). Engineering design thinking, teaching, and learning. Journal of engineering education, 94(1), 103-120.

Duriau, V. J., Reger, R. K., & Pfarrer, M. D. (2007). A content analysis of the content analysis literature in organization studies: Research themes, data sources, and methodological refinements. Organizational research methods, 10(1), 5-34.

Edwards, A., Elwyn, G. and Gwyn, R. (1999). General practice registrar responses to the use of different risk communication tools in simulated consultations: a focus group study. *Bmj*, *319*(7212), pp.749-752.

Edwards, Linda. (1978). Present shock, and how to avoid it abroad. Across the Board, February, 36-43.

EHRLE, R. (1973). INFORMATION DISTORTION. ETC: A Review of General Semantics, 30(2), 141-149. Retrieved from http://www.jstor.org/stable/42576424

Eisenberg, A. M., & R. R. Smith. (1971). Nonverbal communication. Indianapolis: Bobbs-Merrill.

Eriksson, P., & Kovalainen, A. (2010). Case study research in business and management. *Encyclopedia of case study research*, 93-97.

Eriksson, P., & Kovalainen, A. (2010). Case study research in business and management. *Encyclopedia of case study research*, 93-97.

Eyrich, N., Padman, M.L. and Sweetser, K.D., (2008). PR practitioners' use of social media tools and communication technology. *Public relations review*, *34*(4), pp.412-414.
Ferraro, G. P. (2006). The cultural dimension of international business (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Folds, L. (2003). For successful meetings positioning is everything. (poor communication is key problem for modem organizations). Los Angeles Business Journal, 25(6), p. 20.

Forsyth, Donelson R. (2009). Group Dynamics (5th ed.). Boston, MA: Wadsworth Cengage Learning. ISBN 978-0495599524.

Friend, M., & Cook, L. (1992). Interactions: Collaboration skills for school professionals. Longman Publishing Group, 95 Church Street, White Plains, NY 10601.

Ghauri, P. G., & Gronhaug, K. (2002). K. (2005) Research methods in business studies: A practical guide. *Essex: Pearson education limited*.

Glenn, R. E. (1997). SCAMPER for student creativity. The Education Digest, 62(6), 67.

Goel, P. S., & Singh, N. (1998). Creativity and innovation in durable product development. Computers & Industrial Engineering, 35(1-2), 5-8.

Graziano, W. G., Jensen-Campbell, L. A., & Hair, E. C. (1996). Perceiving interpersonal conflict and reacting to it: the case for agreeableness. Journal of personality and social psychology, 70(4), 820.
Griffin, A. (1995). Product Design and Development. The Journal of Product Innovation Management, 12(3), p. 262.

Guffey, M. E., & Loewy, D. (2010). Business communication: Process and product. Cengage Learning.

Guffey, M. E., & Loewy, D. (2010). *Business communication: Process and product*. Cengage Learning.

Harré, R. (1979). Social being: A theory for social psychology. *Totowa, NJ: Littlefield, AdamsHarreSocial Being: A Theory for Social Psychology1979*.

Heath, R.L. and Bryant, J., 2013. Human communication theory and research: Concepts, contexts, and challenges. Routledge.

Holtz, S. 2004. Corporate conversations: A guide to crafting effective and appropriate internal communications. New York: Amacom.

Hua, Z.; Yang, J.; Coulibaly, S.; Zhang, B. (2006). "Integration TRIZ with problem-solving tools: a literature review from 1995 to 2006". International Journal of Business Innovation and Research. 1 (1–2): 111–128. Retrieved 2 October 2010

Huber, G. (1982). Organizational information systems: Determinants of their performance and behavior. Management Science, 28(2), 138-155.

Humphrey, C., & Scapens, R. W. (1996). Methodological themes: theories and case studies of organizational accounting practices: limitation or liberation. *Accounting, Auditing & Accountability Journal*, *9*(4), 86-106.

Janssen, S. (Ed.). (2017). The World Almanac and Book of Facts 2018. Simon and Schuster.

Johnson, C.M. (2001). A survey of current research on online communities of practice. *The internet and higher education*, *4*(1), pp.45-60.

Johnson, C.M. (2001). A survey of current research on online communities of practice. *The internet and higher education*, *4*(1), pp.45-60.

Kehoe, R.R. and Wright, P.M. (2013). The impact of high-performance human resource practices on employees' attitudes and behaviors. Journal of management, 39(2), pp.366-391.

Kelley, T. and Littman, J. (2001) "The Art of Innovation", New York: Currency Books

Kimbell, L. (2011). Rethinking design thinking: Part I. Design and Culture, 3(3), 285-306.

Koschmann, M. (2012). What is organizational communication? URL: http://koschmann. webstarts. com/uploads/what_is_organizational_communication. pdf.

Kreps, G.L. (1986). Organizational communication: Theory and practice. Longman Publishing Group.

Krippendorff, K. (1993). Major metaphors of communication and some constructivist reflections on their use. Cybernetics & human knowing, 2(1), p.3.

Kvale, S. (1992). Ten Standard Responses to Qualitative Research Interviews.

Leonard, D., & Rayport, J. F. (1997). Spark innovation through empathic design. Harvard business review, 75, 102-115.

Li, Y., Wang, J., Li, X., & Zhao, W. (2007). Design creativity in product innovation. The international journal of advanced manufacturing technology, 33(3-4), 213-222.

Maznevski, M. L., & Chudoba, K. M. (2000). Bridging space over time: Global virtual team dynamics and effectiveness. Organization science, 11(5), 473-492.

McCracken, G. (1988). The long interview (Vol. 13). Sage.

Michalko, Michael, (2010). Thinkertoys: A Handbook of Creative-Thinking Techniques. Potter/TenSpeed/Harmony. ISBN 978-0-307-75790-6.

Miller, K.I. (2008). Organizational communication. The international encyclopedia of communication.

Morelli, N. (2006). Developing new product service systems (PSS): methodologies and operational tools. Journal of Cleaner Production, 14(17), 1495-1501

Mou, Z. (2011). The research of communication management in loose project organization.

Perkins, P. S. (2008). The art and science of communication: Tools for effective communication in the workplace. Hoboken, N.J: Wiley.

Redding, W. C. (1972). Communication within the organization. New York; Industrial Communication Council.

Roberts, K. H., & O'Reilly III, C. A. (1974). Failures in upward communication in organizations: Three possible culprits. Academy of Management Journal, 17(2), 205-215.

Rogers, E. & Kincaid, D. (1981). Communication Networks: Toward a New Paradigm for research, NY: Free Press.

Rohrbach, Bernd (1969). "Kreativ nach Regeln – Methode 635, eine neue Technik zum Lösen von Problemen". (Creative by rules - Method 635, a new technique for solving problems)". Absatzwirtschaft. 12: 73–75.

Roozenburg, N.F. and Eekels, J., (1995). *Product design: fundamentals and methods* (Vol. 2). John Wiley & Sons Inc.

S. Pugh (1981) Concept selection: a method that works. In: Hubka, V. (ed.), Review of design methodology. Proceedings international conference on engineering design, March 1981, Rome. Zürich: Heurista, 1981, blz. 497 – 506.

Schneider, S. C. (1987). Information overload: Causes and consequences. Human Systems Management, 7(2), 143-153.

Sosa, M. E., Eppinger, S. D., & Rowles, C. M. (2004). The misalignment of product architecture and organizational structure in complex product development. Management science, 50(12), 1674-1689.

Stoecker, R. (1991). Evaluating and rethinking the case study. *The sociological review*, *39*(1), 88-112.

Subrahmanyam, K. & Greenfield, P. (2008). Online communication and adolescent relationships. *The future of children*, pp.119-146.

Sutton, R. I., & Hargadon, A. (1996). Brainstorming groups in context: Effectiveness in a product design firm. Administrative science quarterly, 685-718.

Tschimmel, K. (2012). Design thinking as an effective Toolkit for Innovation. In ISPIM Conference Proceedings (p. 1). The International Society for Professional Innovation Management (ISPIM).

Ulrich, K. T. (2003). Product design and development. Tata McGraw-Hill Education.

Ulrich. K. T & Eppinger. S. D. (1995). Product Design and Development. McGRAW-HILL INTERNATIONAL EDITIONS. Management and Organisaationa Series. P.19.
Watzlawick, P., Beavin, J., & Jackson, D. (1967). The pragmatics of human communication: A study of interactional patterns, pathologies, and paradoxes. New York: Norton.

Wenberg, J., Wilmot, W. (1973). The personal communication processes. New York: Wiley.

Wiesche, M., Leifer, L., Uebernickel, F., Lang, M., Byler, E., Feldmann, N. ... & Suzuki, S. (2018). Teaching Innovation in Interdisciplinary Environments: Toward a Design Thinking Syllabus. In AIS SIGED International Conference on Information Systems Education and Research.

Wrong, I.F.H. & Phooi-Ching, L. (2000). “Chinese cultural values and performance at job interviews: a Singapore perspective”, Business Communication Quarterly, 63 (1): 9-22.

APPENDICES

Appendix 1

Interview Questions to Participants

Warming-up questions:

1. Can you please tell me about your background? Your major? Country culture?
2. What is the main motivation for you to join the ME310 course?
3. What are the product design process if u recall it, or in your opinion?
4. What did you learn from the ME310 project in general

Teamwork:

1. Did u think every Thursday's SUDS party help your teamwork?
2. Did u set up any goals or objectives in your team? What do you think about the objective thing?
3. Do u have a team leader? Or how does it work in your team? What kind of roles are u playing?
4. Do u come across any team dynamic problems in the teamwork? What are those?
   For instance, if you are not agreed with each? How did u solve it?
   For instance, if somebody don't do anything? Somebody is absent always?
5. What or who causes the miscommunication?
6. As a member of the team, how did u help with the miscommunication problem?
7. Do you feel culture difference when you are collaborating with your teammates? What are those?
   And what did u do to minimize the effect of culture differences?
8. Normally you are from different majors, how do u contribute with each other?

Communication tools

1. What kind of social media channel are u using? Connecting with your global team? Company representative?
2. How did u keep each other updated?

Pitfalls

1. What is the moment that u don't want to continue with this product design project?

Skills

1. What are the skills that you have gained in the product design teamwork? How did u do when there are some team conflicts happening?
2. Do u have something to say for the new me310 students?

Appendix 2

Interview Questions to the Teaching Group

1. What is the product design process?
2. How did you assign the people into different product design teams?
3. How do you instruct the students during the product design process?
4. What king of pitfalls do you think the product design team need to overcome?
5. How did the teaching team help when the product design team have some team dynamic problems?
6. How do you help the design teams set different goals?
7. What do you think the students learned most from this one-year project?
8. How do you feel in general for the whole project with the different design teams?

Appendix 3

Interview Questions to the Company Representatives

1. How do you like the students work and their final design concept? And your expectations?
2. What king of pitfalls do you think the product design team need to overcome?
3. What do you think the students learned most from this one-year project?
4. How do you feel in general for the whole project with the different design teams?
5. What do you suggest the design team to improve in the future?